

## MODIFIED BIOPHYSICAL PROFILE IN ANTEPARTUM FETAL SURVEILLANCE OF HIGH RISK PREGNANCIES

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### ABSTRACT

#### INTRODUCTION:

MODIFIED BIOPHYSICAL PROFILE(MBPP) includes Non stress test (NST) as an indicator of present fetal status and the amniotic fluid index (AFI) as marker of long term fetal status. Antenatal foetal surveillance aims to identify foetuses in high-risk pregnancy groups, such as those with pre-eclampsia, eclampsia, anaemia, oligohydramnios, and other conditions that put them at danger of intrauterine hypoxia and mortality. In such high-risk circumstances, the fetal biophysical profile is one of the most commonly acknowledged tests for assessing foetal well-being. This is prospective observational study conducted between November 2019 to April 2021.

#### AIMS AND OBJECTIVES:

- To study the effectiveness of modified biophysical profile as a primary antepartum fetal surveillance in predicting perinatal outcome of high risk pregnancies.
- To compare morbidity and mortality in relation to each of the modified biophysical profile's characteristics, namely NST and AFI, individually.

**INCLUSION CRITERIA:** Gestational age of 30 weeks or more, Pre eclampsia, Anemia, Heart disease complicating pregnancy, Gestational Diabetes mellitus/overt diabetes.

**EXCLUSION CRITERIA:** Patient refusal or inability to provide informed consent, Fetuses with congenital anomalies, Multifetal pregnancies, Intrauterine fetal demise.

**RESULTS :** Majority of the cases are in the age group of 21-25 years(46%) and majority of the cases were primigravidae(42%).

Hypertensive disorders of pregnancy is seen in majority of the cases(46%).

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.

Incidence of perinatal morbidity and mortality is increased when both MBPP parameters were abnormal.

**CONCLUSION :** Modified biophysical profile (MBPP) is easier, less time consuming, cost effective and patient compliant test. 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.

## INTRODUCTION :

The Manning score or BPP (Biophysical Profile) provides a detailed assessment of the fetus behavioral state in utero. It is used both as a backup test when the non-stress test is non-reactive and as a first-line test for antepartum fetal surveillance. Manning and colleagues proposed the combined use of five fetal biophysical variables as a more accurate means of assessing fetal health than a single element<sup>1</sup>. These tests usually take 30 to 60 minutes for the examiner to complete.

The fetal biophysical components which are assessed are (1) heart rate acceleration, (2) breathing, (3) movements, (4) tone, and (5) amniotic fluid volume. Normal variables were assigned a score of 2 each, and abnormal variables were given a score of 0. Thus, the highest score possible for a normal fetus is 10. Another suggestion was to focus on two major components of BPP: amniotic fluid and NST, to reduce BPP testing time without compromising fetal health. This is called **MODIFIED BIOPHYSICAL PROFILE(MBPP)**. Nageotte et al<sup>2</sup> propose a modified biophysical profile (MBPP) that includes the non-stress test (NST) as an indicator of current fetal status and the amniotic fluid index (AFI) as a marker of long-term fetal status. The modified biophysical profile (MBPP) is easier to perform and takes less time than the complete biophysical profile or contraction stress test. Also, MBPP is considered to be as effective as the complete biophysical profile. This improved biophysical profile took about 20 minutes to complete and is a useful surveillance tool. The modified biophysical profile is being used as a primary surveillance test in high-risk pregnancies to study its effectiveness in predicting perinatal outcome.

The American College of Obstetricians and Gynecologists (2016) has concluded that the modified biophysical profile test is as predictive of fetal well-being as other approaches to biophysical fetal surveillance<sup>3</sup>

## AIMS AND OBJECTIVES

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## MATERIAL AND METHODS

This is an observational study carried out at Gandhi hospital over a period of 18 months. It is a tertiary care hospital and a major referral center for high-risk obstetrics in Telangana State. 90 women who are diagnosed with high-risk factors are included in the study. Written informed consent was taken from all women recruited into the study after explaining the nature of the study. Details were entered in a pre-designed proforma regarding the Age, parity, gestational age, booking status at our hospital, high-risk factors like hypertensive disorders, diabetes mellitus, oligohydramnios, intrauterine fetal death, and lethal fetal congenital anomalies. All basic investigations were done an antenatal scan for AFI and fetal biometry, NST tracing for 20 mins and additional investigations like Liver function tests, 24-hour urinary proteins, spot protein creatinine ratio, fetal doppler were done depending on maternal condition.

## INCLUSION CRITERIA:

- Gestational age of 30 weeks or more
- Preeclampsia
- Anemia

- Heart disease complicating pregnancy
- Gestational Diabetes mellitus/overt diabetes

**EXCLUSION CRITERIA:**

- Patient refusal or inability to provide informed consent.
- Fetuses with congenital anomalies
- Multifetal pregnancies.
- Intrauterine fetal demise.

**Test results were documented as follows:**

NST was conducted with a cardiotocograph after informed consent was obtained. FHR, fetal movements, and uterine contractions were all recorded. When the baseline fetal heart rate is between 110 and 160 beats per minute, and there are more than two accelerations of more than or equal to 15 beats per minute lasting more than or equal to 15 seconds, with good beat-to-beat variability and no decelerations, the trace is called reactive. If the reaction pattern was not recorded after 20 minutes, the test was repeated for another 20 minutes, or intravenous fluids were administered and the NST was repeated. The trace was declared non-reactive if there was no reactivity within this time period. The four-quadrant approach is used to determine the volume of amniotic fluid. The uterus was split into four equal quadrants by two imaginary lines while the patient was supine. The linea alba and a transverse line equidistant from the pubic symphysis to the top of the fundus are the vertical and transverse lines, respectively. The AFI was calculated by adding the depths of the greatest vertical pockets in each quadrant that are cord-free. In my study, an AFI of >5 is considered normal, and an AFI of 24cm was regarded as the maximum limit of normal. The management of the patient was determined based on gestational age, other risk factors, and the results of the MBPP.

**Endpoints for assessment of the outcome of pregnancy:**

- Thick meconium staining of liquor
- 5minute Apgar score.
- NICU admissions
- 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.

- Perinatal morbidity is measured in terms of low APGAR scores, NICU admissions, and the need for resuscitative measures.

**STATISTICAL ANALYSIS:**

Descriptive statistics such as frequencies and percentages for categorical variables were determined. Association between variables was analyzed by using the Chi-Square test for categorical variables with a p-value less than 0.05 considered statistically significant.

**RESULTS****Distribution of risk factors:(Table/Fig-1)**

Out of 90 cases; the majority of cases constitute hypertensive disorders(47%), followed by postdates, anemia and hypothyroidism (11%), Diabetes mellitus (10%),

**Table/Fig-1: Distribution of Risk factors**

Mode of Delivery	Number	%
FTVD	29	32
PTVD	17	19
FT LSCS-Emergency	30	33
PT LSCS-Elective	14	16

**Mode of delivery:(Table/Fig 2)**

Out of 90 patients, 46 (51%) of them had vaginal delivery and 44(49%) of them had cesarean section. Out of the 46 patients who had vaginal delivery 29 of them (32%) had a full-term vaginal delivery and 17 of them (19%) had a preterm vaginal delivery. Out of the 44 patients who had cesarean section 33% of them had full-term emergency LSCS and 16% of them had preterm emergency LSCS.

**Table/Fig 2: Mode of Delivery**

<b>RISK FACTORS</b>	Number	%
Hypertensive disorders in pregnancy	42	47
BOH	4	4
Post dates	10	11
↓Fetal movements	3	3
Diabetes Mellitus	9	10
Hypothyroidism	10	11
RHD	2	2.2
Anemia	10	11

**Last MBPP result:(Table/Fig 3)**

Among the modified biophysical profiles done in 90 patients, both parameters(NST and AFI) were normal in 51 patients (57%), both parameters were abnormal in 7 patients (8%), NST was normal and AFI was abnormal in 7 patients (8%), AFI was normal and NST was abnormal in 25 patients (27%).

**Table/Fig 3: Last MBPP result**

	Number	%
Both parameters normal	51	57
Both parameters abnormal	7	8

NST normal AFI abnormal	7	8
NST abnormal AFI normal	25	27

#### Last test results versus mode of delivery: (Table/Fig 4)

Among the modified biophysical profiles done in 90 patients when both parameters (NST and AFI) were normal (51 patients) 13(25%) patients underwent LSCS and 38(75%) patients had vaginal delivery, when both parameters were abnormal (7 patients) 5 (71%) patients underwent LSCS and 2 (29%) patients had vaginal delivery when NST was normal and only AFI was abnormal (7patients) 2 (29%) patients had vaginal delivery & 5(71%) of them underwent LSCS, when AFI was normal and NST was abnormal(25patients) 21 patients (84%) underwent LSCS and 4(16%) patients had vaginal delivery.

**Table/Fig 4: Last test results versus mode of delivery**

	LSCS	Vaginal delivery	P-value
Both parameters normal (51)	13	38	<0.001
Both parameters abnormal (7)	5	2	0.214
NST normal AFI abnormal (7)	5	2	0.214
NST abnormal AFI normal (25)	21	4	<0.001

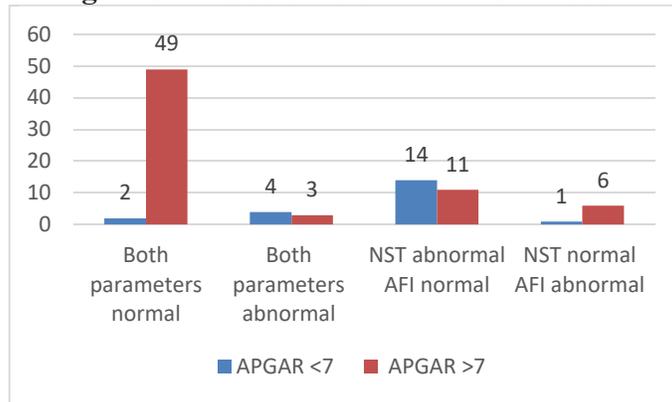
#### Last test result versus APGAR score at five minutes:(Table/Fig 5)

Among the 90 cases included in the study, an APGAR score of <7 was observed among 21 cases. when both parameters (NST and AFI) were normal 2 patients had an APGAR score of <7, when both parameters were abnormal 4 patients had an APGAR score of <7, when NST was normal and AFI was abnormal 1 of the patients had an APGAR score of <7 and when AFI was normal and NST was abnormal 14 patients had APGAR score of <7.

**Table 5: Last test result Vs APGAR score**

	APGAR <7	APGAR >7	P-value
Both parameters normal (51)	2	49	<0.001
Both parameters abnormal (7)	4	3	0.026
NST normal AFI abnormal (7)	1	6	0.556
NST abnormal AFI normal (25)	14	11	<0.001

**Figure 5: Last test result Vs APGAR score**



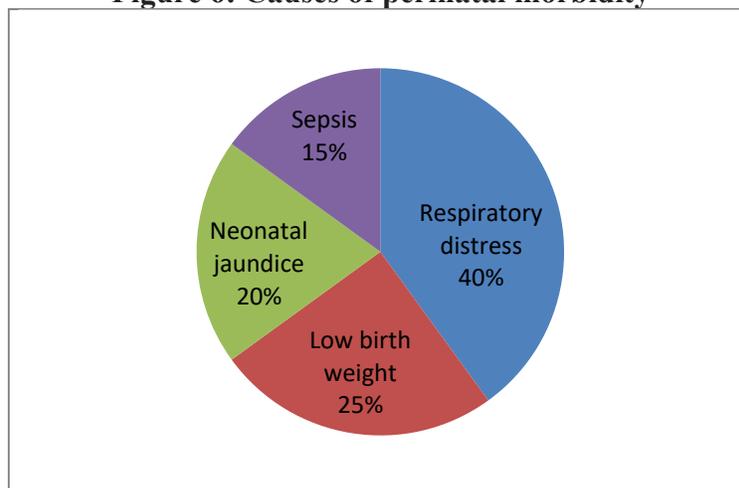
**Perinatal morbidity associated with test results :(Table/Fig 7)**

When both parameters (NST and AFI) were normal perinatal morbidity was present in 4 out of 51 cases, when both parameters were abnormal 3 out of 7(42%) of them had perinatal morbidity. when NST was normal and AFI was abnormal perinatal morbidity was present in 2 out of 7(28%) cases and when AFI was normal and NST was abnormal 11 out of 25 (44%) of them had perinatal morbidity.

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

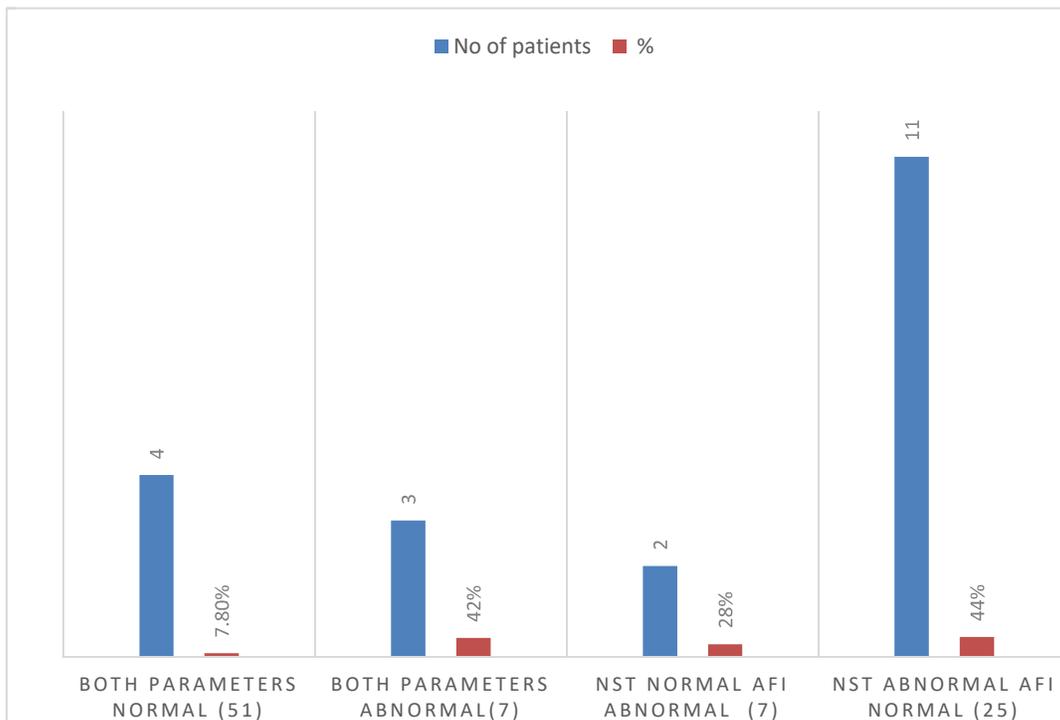
Perinatal morbidity is observed in 20 cases that were admitted to NICU. Of which 8 cases were admitted because of respiratory distress, 5 cases because of low birth weight, 4 cases because of neonatal jaundice, and 3 cases because of sepsis.(Figure 6)

**Figure 6: Causes of perinatal morbidity**



**Table 7: Perinatal morbidity associated with test results**

	No of patients	%
Both parameters normal (51)	4	7.8%
Both parameters abnormal(7)	3	42%
NST normal AFI abnormal (7)	2	28%
NST abnormal AFI normal (25)	11	44%

**Figure 7: Perinatal morbidity associated with test results****Perinatal mortality associated with test results: (Table/ Figure 8)**

In our study, there were 11 perinatal mortalities. Eight cases had hypertensive disorders of pregnancy and one had diabetes and two had come with decreased fetal movements. MBPP was abnormal in 2 cases. The NST in all 11 cases was non-reactive and AFI was abnormal in five

cases. Two cases belonged to 30 weeks of gestation and One case was of 31 weeks of gestation, one belonged to 32 weeks gestation, One case was of 33 weeks gestation four cases were in between 34 to 35 weeks of gestation. One case was of 36 weeks of gestation and one belonged to 38 weeks of gestation. The birth weight of the babies was <1.5 in three cases, between 1.5-2.4 kg in 6 cases, and 2.5-3kg in 2 cases.

**Table/ Figure 8: Perinatal mortality associated with test results**

RISK FACTOR	NST	AFI	GA IN WEEKS	WEIGHT IN KGS	CAUSE OF DEATH
SPE	NR	9-10cms	34	1.5	Low birth wt with birth asphyxia
Decreased fetal movements	NR	0-1cm	33	1.7	Birth asphyxia
GHTN *	NR	1cm	35	1.7	MSL with fetal distress
SPE**	NR	12-13cm	30	1.2	Low birth wt
APE‡	NR	9-10cm	32	1.5	Birth asphyxia
Decreased fetal movements	NR	0-1cm	35	2.5	MSL with asphyxia
SPE	NR	0-1cm	34	1.2	Low birth wt
GHTN	NR	7-8cm	38	2.7	MSL with fetal distress
SPE	NR	9cm	30	1	Very low birth wt
Diabetes	NR	15-16cm	31	1.5	Fetal distress
SPE	NR	24cm	36	1.5	Birth asphyxia

\*GHTN- Gestational hypertension, \*\* SPE - Severe preeclampsia, † - Antepartum eclampsia

## DISCUSSION:

The main purpose of antepartum fetal surveillance is to detect a damaged fetus early and intervene quickly. There are several approaches, but the best one is one that attempts to identify the fetus that is at risk but still in a healthy state and requires quick care. In the present study, the modified biophysical profile (MBPP), which is a combination of two parameters, is used as a primary surveillance test for high-risk patients. The two parameters are the non-stress test (NST), which is a short-term marker of fetal status & amniotic fluid index (AFI), a long-term marker of placental function.

The major risk encountered in this study was hypertensive disorders in pregnancy. The percentage of hypertensive disorders in pregnancy is 46.6% which is high compared to the other studies. In a study conducted by Borade et al<sup>4</sup>, similar to our study, hypertension was the most predominant risk factor in the mother after prolonged pregnancy with no other risk factor. Vijayalakshmi et al<sup>5</sup> also reported hypertension to be the most common cause of risk in 25% of the patients which was followed by decreased fetal movements and oligohydramnios.

The majority of the patients were primigravidae (42%) and the majority of them were in the age group of 21-25yrs (46%).

The mode of delivery in the study group concerning the last MBPP result showed that when MBPP was normal concerning both parameters (51), the incidence of LSCS and vaginal delivery among these were 25% and 75% respectively. When the MBPP was abnormal concerning both parameters 71% of the cases had LSCS and 29% of them had a 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 results are similar to study conducted by Dungal et al<sup>7</sup> where most of the cases (70/97, 72%) in normal MBPP group had vaginal delivery and most of the cases in abnormal MBPP had cesarean section (56/75, 76%).

In our study, the incidence of cesarean section for fetal distress was very high (45%) compared to other study by Borade et al<sup>4</sup>.

When studied concerning the last MBPP, showed that whenever both the test results were abnormal, we had 42.8% (3 out of 7 cases) showing thick meconium. When the test results were abnormal concerning only NST only 28% had thick meconium. When the test results were abnormal concerning only AFI 0 patients had thick meconium. Hence from the above results, it is seen that the incidence of perinatal morbidity concerning meconium is increased when both MBPP parameters were abnormal, and more so when NST was abnormal compared to AFI abnormal when individual parameters were considered. The results are similar to the study by Pavitra reddy et al<sup>8</sup> where thick meconium was observed in 30.3% of patients with only abnormal NST.

Among the 90 cases included in this study, an APGAR score of <7 at 5 minutes was observed among 21(23%) cases. Out of which 19 cases which account for 90.4% had abnormal MBPP and 2 cases which account for 9.6% had normal MBPP. The results of our study were compared to those of Singh G et al<sup>6</sup>.

In the present study out of 20 babies (22.2%) which were admitted to NICU, 12 cases had abnormal MBPP(80%). This is comparable to an earlier study by Borade et al and Agarwal et al<sup>9</sup>.

In our study, there were 11 (12.2%) perinatal mortalities wherein 8 cases were those with pre-eclampsia, two patients came with decreased fetal movements.

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.

## CONCLUSION

- The modified biophysical profile (MBPP) is a simpler, faster, and less expensive test.
- When the Modified biophysical profile is normal, it gives reassurance that the fetal status is good with a good perinatal outcome. At the same time, abnormal MBPP signals that the fetus's health may be jeopardized.
- When the MBPP is abnormal there is an increased incidence of perinatal morbidity as well as mortality. Confirmation with a complete biophysical profile can be done when MBPP results are abnormal.
- When considered individually, abnormal AFI was associated with increased incidence of perinatal morbidity and abnormal NST was associated with increased incidence of perinatal morbidity as well as perinatal mortality.

- In high-risk pregnancies, MBPP is an effective primary antepartum fetal surveillance test for predicting perinatal outcomes and providing prompt intervention.
- The fetal death rate is lower in the population undergoing antepartum testing as compared to the general untested population. Protocols using adjunctive tests (Biophysical profile, color Doppler) help to further improve obstetric outcomes. We can save the babies in cases of non-reactive non-stress tests by prompt termination of pregnancy when the baby was salvageable.

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