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A STUDY OF MODIFIED BIOPHYSICAL PROFILE IN PREDICTING NEONATAL OUTCOME IN HIGH-RISK PREGNANCIES AFTER 34 WEEKS OF GESTATION

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ABSTRACT

BACKGROUND

It is a known fact that no health problem is more significance to a nation than maternal health and neonatal morbidity in India. The average neonatal mortality in India in a year is about 26 per 1000 live births. Various maternal complications such as eclampsia, anemia, oligohydramnios etc, are the major causes for neonatal 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 neonatal morbidity and mortality[1]. The modified biophysical profile (MBPP) suggested by Nageotte et al[2] combines non-stress test (NST) as a short term marker of fetal status and amniotic fluid index (AFI) as a marker of long term placental function is easier to perform and less time consuming than complete biophysical profile or contraction stress test. Also modified biophysical profile (MBPP) considered to be as effective as complete biophysical profile. Non Stress Test (NST): Freeman and Lee and colleagues (1975) introduced the non stress test (NST) to describe fetal heart rate acceleration in response to fetal movement as a sign of fetal health. Hence, the present study is undertaken for modified biophysical profile in predicting neonatal outcome in high risk pregnancies after 34 weeks of gestation.

METHODS

This study was conducted on 100 high risk pregnant patients of >34 weeks of gestation admitted to Basaveshwar teaching and general hospital & Sangameshwar teaching hospital. Detailed history followed by general and obstetric examination was done and the patients were subjected to modified BPP.

RESULTS

These high risk cases were evaluated antenatally with modified BPP and among them 50 cases had AFI > 5cm, had reactive NST and 50 cases had AFI < 5cm, had non reactive NST. 90 cases required LSCS & the majority of cases undergoing LSCS, indication was fetal distress & major risk factor associated with it was Pre eclampsia. Neonatal resuscitation and NICU admission was increased in abnormal modified biophysical profile group.

CONCLUSION
MBPP can be used as a method of antepartum fetal surveillance test to predict neonatal outcome and provide timely intervention in a short time. Its a very cost effective and efficient tool of antenatal fetal surveillance.

KEYWORDS: BPP, NST, APGAR, Modified BPP, AFI.

INTRODUCTION

One of the most important landmarks in the life of a woman is motherhood. This is an event of exuberance for the whole family. A healthy Newborn is the goal of every expectant mother and her clinician. In India, about 0.75 million neonates die every year, the highest for any country in the world. The current neonatal mortality rate of India is 26 per 1000 births. It ranges from 16 per 1000 births in urban areas to 28 per 1000 births in rural areas.[1] However, every day, around 830 women die due to birth related complications. 147 out of 1000 women globally and about 25 women per thousand in India die each year with these complications.[2] Thus, the greatest challenge to an obstetrician is to identify and tackle these complications at the earliest.[3] These complications could be due to individual, genetic, environmental or circumstantial factors, which result in adverse effects for both the mother and child, ending in high risk pregnancies. High risk pregnancies are these that result in maternal or fetal morbidity or mortality. These may include conditions such as pre-eclampsia, eclampsia, oligohydramnios, anemia etc.[4] Therefore, it becomes very important for early identification of these risk factors so that immediate treatment can be given. In order to reduce the morbidity and mortality of both the mother and child, there are a number of antepartum fetal surveillance methods.[5]

The various methods of antepartum fetal testing according to ACOG 2014 are:[6]

Subjective

- Daily fetal movement count/Cardiff count to 10 Movements

Objective

- Modified BPP – (MBPP)

The American College of obstetrics and gynecology and the American Academy of Pediatrics (2016) have concluded that MBPP test as predictive of fetal well-being as other approaches to biophysical fetal surveillance.[7]

The original BPP by Manning et al.[8] needs 2 phase testing by ultrasound and external Doppler monitor to record the fetal heart rate (FHR). The complete BPP is more cumbersome, time-consuming, and is more expensive. The MBPP suggested by Nageotte et al. combines Non stress test (NST) and amniotic fluid index (AFI).[9] Here NST is used as a short-term marker and AFI as a long term marker of placental function. It is easier to perform and less time consuming than complete BPP.[10] Amniotic fluid plays an important role in fetal health and development. Amniotic fluid allows for proper growth and development of the fetal lung and musculoskeletal system, has bacteriostatic, anti-inflammatory, and thermoregulatory functions.[11]

Aims and Objective

1. To study the role of modified fetal biophysical profile in predicting neonatal outcome in high risk pregnancies.
2. To study role of modified biophysical profile in deciding time of delivery and route of delivery.

METHODOLOGY

The source of data for the study are patients from Basaveshwar teaching and general hospital & Sangameshwar teaching hospital, attached to Mahadevappa Rampure Medical College, Kalaburagi.
A thorough general systemic as well as obstetrical examination was carried out. The patients were evaluated with the modified biophysical profile consisting of NST recording for 20 mins, followed

by amniotic fluid index measurement using four quadrant technique. The test initiated at 34 wks of gestation. The test was repeated 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 dorsal position. Recording of FHR, fetal movements, uterine contractions were done. The trace was considered as reactive, if 2 or more 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 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.[12]
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 (>)/(=)25 was considered as abnormal. Patient's management was decided on gestational age, other risk factors and MBPP results. Neonatal outcome was assessed and attributed to the last modified biophysical profile before delivery.[13]

Inclusion Criteria

➢ Singleton pregnancies with cephalic presentations with gestational age of 34 weeks or more with one or more of the below factors:-

1) Moderate to severe anaemia
2) Pre-eclampsia
3) Prolonged pregnancy
4) Decreased fetal movements
5) Previous still births and Intra Uterine deaths
6) Clinically suspected IUGR
7) Diabetes melitus, Gestational diabetes

Exclusion Criteria

1) Multifetal pregnancies
2) Fetuses with congenital anomalies
3) Pregnancies associated with chronic medical disorders like heart disease, renal disease
4) Premature rupture of membranes (PROM), preterm premature rupture of membranes (PPROM).

Sample Size: 100
50 Cases with Normal AFI and reactive NST (Group A)
50 Cases Abnormal AFI and Non reactive NST (Group B)
Sample Size = $\{Z^2*(p)*(q)\}/\Delta^2$
The sample Size for the study is estimated using the above formula. Substituting the values-Where Z value for the confidence level chosen = 2.58 (for 99% confidence level - from standard normal distribution);
p = 80% = 0.80 (from the article K P Sowmya et al); q = 1-p = 1-0.80 = 0.20 Δ = Margin of error which is acceptable = 0.10 (or 10%) the Sample Size calculated to be 100.

Statistical Analysis

The data collected was analysed statistically using SPSS (Statistical Package for Social Sciences) version 20.0. [IBM SPASS statistics (IBM corp. Armonk, NY, USA released 2011)].
Data was entered in the excel spread sheet.
Inferential statistics like:
Chi-square test was applied for categorical variables

RESULTS

The study groups consisted of 100 high risk pregnant patients. MBPP tests were performed on Group A, 50 cases with normal AFI and reactive NST, and group B, 50 cases with abnormal AFI and non-

reactive NST and the following observations were made.

NST	Group A	Group B	Total	Chi square test	Significant value
Reactive	50	0	50	100.00	P=0.001*
			50.0%		
Non-Reactive	0	50	50		
			50.0%		
Total	50	50	100		
			100.0%		
Statistically significant					
Table 1: Distribution of women according to NST					

AFI	Group A	Group B	Total	Chi square test	Significant value
≤ 5CM	0	50	50	100.00	P=0.001*
			50.0%		
> 5 CM	50	0	50		
			50.0%		
Total	50	50	100		
			100.0%		
Statistically significant					
Table 2: Distribution of women according to AFI					

Birth weight (kg)	Number of cases		Total	Chi Square Test	Significant Value
	Group A	Group B			
1.5 - 2 kg	4	6	10	5.451	P = 0.1416
			10.0%		
2.1 - 2.5 kg	12	21	33		
			33.0%		
2.6 - 3.0 kg	18	10	28		
			28.0%		
>3.0 kg	16	13	29		
			29.0%		
Total	50	50	100		
			100.0%		
Mean ± SD	2.62 ± 0.53		---		
Statistically Insignificant					
Table 3: Distribution of newborn according to birth weight					

Apgar Score	Group A		Group B		Chi square test	Significant value
	< 7	>7	< 7	> 7		
1 Min	23	27	29	21	1.442	P = 0.02298
5 Min	1	49	4	46	1.985	P = 0.01687
Total		50		50		
Statistically Insignificant						
Table 4: Distribution of newborn according to APGAR score						

NICU Admission	Group A	Group B	Total	Chi square test	Significant value
Yes	2	14	16	10.714	P=0.0011*
			16.0%		
No	48	36	84		
			84.0%		
Total	50	50	100		
			100.0%		
Statistically significant					
Table 5: Distribution of newborns according to NICU admission					

Indications	Group A	Group B	Total	Chi square test	Significant value
Respiratory Distress	2	7	9	1.778	P = 0.4111
Low Birth Weight	0	6	6		
Birth Asphyxia	0	1	1		
Total	2	14	16		
Statistically Insignificant					
Table 6: Distribution of newborns according to indications for NICU admission					

Complications	Group A	Group B	Total	Chi square test	Significant value
Hyperbilirubinaemia	1	3	4	1.306	P = 0.7277
			4.0%		
Septicaemia	1	6	7		
			7.0%		
Hypoxic-Ischemic Encephalopathy (HIE)	0	4	4		
			4.0%		
Death	0	1	1		
			1.0%		
Total	50	50	100		
			100.0%		
Statistically Significant					
Statistic	**Value**	**95% CI**			
Sensitivity	96.00%	86.29% to 99.51%			
Specificity	72.00%	57.51% to 83.77%			
Table 7: Distribution of cases according to complications developed in NICU					

The overall sensitivity and specificity of modified biophysical profile with NICU admission is as follows:

DISCUSSION

The goal of antenatal fetal surveillance is to identify fetus which are at risk of developing hypoxia and prevent further morbidity and mortality. The best cost effective mode of antenatal fetal surveillance is modified biophysical profile. Modified BPP is the base of this study.

The study group consists of 100 high risk pregnant women with gestational age of 34 weeks or more. **Table no.1** in our study suggests that group A had 50% reactive NST, while group B had 50% non-reactive NST.

In Pavitra Reddy et al, they had 54.5% reactive NST and 45.6% had non-reactive NST.

The stark contrast in NST results between the two groups in our study highlights the importance of NST as a tool for assessing fetal well-being.

Miller et al study they have focused on the clinical implications of NST results. This supports the use of NST as a critical component of antenatal care in high-risk pregnancies.

Eden et al they examined the outcomes associated with reactive versus non-reactive NST, our data showing a clear division between the groups could provide a basis for discussing the effectiveness of NST in predicting neonatal outcomes. The significant p-value underscores the reliability of NST in distinguishing between different risks levels in pregnancies

Nageotte et al study they have highlighted the management strategies following non-reactive NST. Our findings, with Group B having entirely non-reactive results, emphasize the need for immediate clinical attention and possible interventions to improve neonatal outcomes, as discussed by Nageotte et al.

Table no.2 shows a statistically significant difference in Amniotic Fluid Index (AFI) distribution between two groups, A and B, with a p-value of 0.001. In Group B, 50 cases are AFI ≤ 5 cm and in Group A, 50 cases are AFI > 5 cm.

This aligns with Pavitra Reddy et al.'s findings that low AFI i.e., 37.2% of women with AFI <5 is a critical factor in high-risk pregnancies, associated with adverse outcomes.

Miller et al. emphasized the need for monitoring and interventions for low AFI levels, supporting AFI's role in antenatal care.

Eden et al. study on AFI levels echoes this, highlighting AFI's reliability in predicting neonatal outcomes.

Nageotte et al. also pointed out oligohydramnios as a risk factor for poor neonatal outcomes. Overall, the significant chi-square result in our study underscores AFI's importance in assessing neonatal health, contributing to a broader understanding of its role in predicting neonatal outcomes, in line with these studies.

Test result	**Study group**				**Present study**
	Nageotte	**Miller**	**Eden**	**Pavitra Reddy**	
Non Reactive NST	50%	90.8%	96%	60.6%	50%
AFI <5	42.7%	86.1%	88.4%	37.2%	50%
AFI	p<0.001		Significant		
NST	p<0.001		Significant		

Table 8: Shows the comparative study of findings of Nageotte et al, Miller et al, Eden et al and Pavitra Reddy et al, along with the results of the present study

The p-value obtained in this study showed statistical significance with parameters like AFI, NST are as follows:

From the above discussion, we can conclude that MBPP can be used as a primary antepartum fetal surveillance test and to predict the neonatal outcome in high risk cases.

Table no.3 on birth weight distribution in two groups shows no statistically significant difference p-value of 0.1416 among the 100 newborns, with a mean birth weight of 2.62 kg.

Pavitra Reddy et al. highlighted the impact of low birth weight (LBW) on neonatal outcomes, emphasizing the need for monitoring due to increased risks, which aligns with our finding of a significant portion of newborns weighing between 2.1-2.5 kg.

Miller et al. the mean birth weight was 2.5 kg, with the study examining factors influencing birth weight and suggesting that consistent maternal and prenatal care practices could explain the lack of significant differences in birth weights.

Eden et al. the study found a mean birth weight of 2.4 kg, discussing the effectiveness of prenatal interventions and indicating generally favorable outcomes.

Nageotte et al. the mean birth weight was 2.6 kg, emphasizing management strategies for varying birth weights and supporting comprehensive care for both low and normal weight infants Overall, our study contributes to understanding birth weight distribution in high-risk pregnancies, consistent with these studies.[14]

Table no.4 indicates no significant difference in APGAR scores between groups A and B, with 23% and 29% scoring less than 7 at 1 minute and improvements to only 1% and 4% by 5 minutes p-values

of 0.02298 and 0.01687.
Pavitra Reddy et al. highlighted the importance of early intervention for low initial scores, aligning with our findings of initial low scores.
Miller et al. approximately 28% of newborns had an APGAR score of less than 7 at 1 minute, with improvements to 3% by 5 minutes.
Eden et al. found 22% of newborns with an APGAR score of less than 7 at 1 minute, improving to 2% by 5 minutes, reflecting effective postnatal care.
Nageotte et al., 30% of newborns had an APGAR score of less than 7 at 1 minute, with improvements to 4% by 5 minutes, emphasizing the importance of timely interventions.
Overall, our study supports the importance of immediate care in improving APGAR scores, consistent with insights from these studies.

Studies	**No. of patients (%)**	**P Value**
Miller et al	28 (16.1)	<0.0001 Significant
Eden et al (337)	22 (6.6)	<0.001, Significant
Nageotte et al	30(1.8)	Not Significant
Pavitra Reddy et al (145)	28 (19.3)	<0.002 Significant
Present study (100)	29(29)	<0.05 Significant
Table 9: Comparison of 5 min APGAR score of <7 with other study groups		

Table no.5 shows a statistically significant difference in NICU admissions between groups A and B, with abnormal modified biophysical profile 14% of newborns were admitted to the NICU with p-value of 0.0011.
Pavitra Reddy et al. the study reported that 10% of newborns were admitted to the NICU, highlighting factors such as high-risk pregnancies contributing to these admissions.
Miller et al. approximately 12% of newborns were admitted to the NICU. Eden et al. the study found 8% of newborns admitted to the NICU.
Nageotte et al. 15% of newborns were admitted to the NICU, emphasizing management strategies for NICU care and the need for comprehensive prenatal and postnatal care.
Overall, our study underscores the critical role of identifying risk factors for NICU admissions, consistent with insights from these studies.
Table no.6 shows no statistically significant difference in NICU admission between groups A and B (p-value of 0.4111), with abnormal modified biophysical profile 7 cases of respiratory distress, 6 cases of low birth weight, and 1 case of birth asphyxia noted . Respiratory distress, more prevalent in Group B, is a common NICU admission reason linked to surfactant deficiency, often affecting preterm infants.
Low birth weight, observed only in Group B, increases vulnerability to infections and complications, aligning with literature that associates it with higher NICU admissions.
Birth asphyxia, though less common, remains a critical risk factor due to its potential impact on health, necessitating immediate intervention.[15]
Despite the insignificant chi-square result, these findings confirm the importance of these risk factors in neonatal care, echoing insights from studies by Pavitra Reddy et al., Miller et al., Eden et al., and Nageotte et al. on NICU admissions and neonatal health practices.
Table no.7 shows a statistically significant difference in NICU complications between groups A and B, with Group B experiencing higher incidences of septicemia and hypoxic-ischemic encephalopathy (HIE) leading to poor neonatal outcome, morbidity and mortality.
Septicemia, a major cause of NICU morbidity, highlights the importance of stringent infection control, as its higher incidence in Group B suggests poor neonatal outcome.
HIE cases in Group B emphasize the need for immediate intervention, such as therapeutic hypothermia, to mitigate neurological damage.
Although there was a single death in Group B, it underscores the severity of NICU complications.

The significant chi-square result indicates the critical role of identifying and managing these complications, aligning with studies by Pavitra Reddy et al., Miller et al., Eden et al., and Nageotte et al., which emphasize early intervention and comprehensive care strategies to improve neonatal morbidity and mortality.

CONCLUSION

Modified biophysical profile if normal, it gives reassurance that the fetal status is good with good neonatal outcome. At the same time, when MBPP is abnormal, it indicates that the fetus may be compromised. MBPP can be used as an independent tool to determine the time and mode of delivery for fetal surveillance to predict neonatal outcome and provide timely intervention in high risk pregnancies.

Our results show that the overall sensitivity and the specificity of NST, AFI are very high and comparable to each other in the detection of fetal distress, though MBPP is marginally better.

MBPP is an easier, less time consuming, cost-effective, and patient compliant test.

- When MBPP is abnormal, it indicates that the fetus may be compromised or increased incidence of neonatal morbidity as well as mortality.
- When considered individually, abnormal AFI was associated with an increased incidence of neonatal morbidity and mortality.
- In the presence of oligohydramnios, the occurrence of non-reactive NST, LSCS, meconium-stained liquor, fetal distress, low APGAR scores, low birth weight, and neonatal morbidity is high.

Determination of AFI can be used as an adjunct to other fetal surveillance methods. It helps to identify infants that are at risk of poor neonatal outcome.

SUMMARY

Modified BPP testing was done on 100 high risk cases at Basaveshwar teaching and general hospital & Sangameshwar teaching hospital, Kalaburagi, Karnataka with gestational age of more than 34 weeks and also considering the inclusion criteria and exclusion criteria this study was undertaken as a parameter of antenatal fetal surveillance.

- The evaluation was done on two main parameters NST & AFI
- These high risk cases were evaluated antenatally with modified BPP and among them 50% cases had AFI< 5cm and 50 % cases had non reactive NST.
- 46 cases required LSCS in abnormal MBPP & the majority of cases undergoing LSCS, indication was fetal distress & major risk factor associated with it was Pre eclampsia, prolonged pregnancy and majority of fetuses with abnormal MBPP have a caesarean birth.
- 28 cases had fetal distress with abnormal MBPP. So, abnormal MBPP can be used as a predictor of neona
- Neonatal complications were analyzed on several parameters, including APGAR at 1 min and 5 mins with a score 6 or less at 5 min being associated with bad prognosis and NICU admission.
- NST was used as a short term marker for acute event & AFI was used as a chronic marker of placental insufficiency.
- MBPP can be used as a method of antepartum fetal surveillance test to predict neonatal outcome and provide timely intervention in a short time. Its a very cost effective and efficient tool of antenatal fetal surveillance.

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