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Original Research Article

The role of modified biophysical profile in high risk pregnancies and fetal outcome

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Abstract

Objectives: In a high risk population where chances of adverse outcome are relatively high and almost all the pregnancies are under strict monitoring, biophysical profiling further helps to identify adverse outcome and thus a basis for intervention. In this study, we aim to evaluate the role of modified biophysical profile in high risk pregnancies and fetal outcome.
Methods: Total 125 high risk pregnancies and were monitored for modified biophysical profiling from GA 34 weeks onwards. AFI<8 and non-reactive NST were considered as abnormal BPP. Apgar <7 at 5 min, MSL, NNU admission and neonatal death were considered as adverse fetal outcomes. Chi-square test was used to compare the data.
Results: Mean age was 24.32±4.37 (range 19-35) years. Mean age at enrolment was 35.23±1.78 weeks. A total of 41 (32.8%) patients had AFI<8. Non-reactive NST was seen in 52 (41.6%) patients. Overall abnormal biophysical profile (NR-NST/AFI<8) was seen in 62 (49.6%) patients. Incidence of meconium stained liquor, Apgar<7 at 5m, NNU admission and NNU expiry was 15.2%, 20.8%, 26.4% and 4.0% respectively. NST and overall BPP showed a statistically significant association with all the outcomes however, AFI failed to show a significant association with NNU expiry. For all the outcomes NST had higher sensitivity as compared to AFI. Combined BPP showed a higher sensitivity than either of two components.
Conclusion: Modified BPP was found to be useful in identification of adverse fetal outcomes, thus highlighting its role in planning interventions to avert extreme events.
Keywords: Biophysical profile, Non-stress test, Fetal, Pregnancy, AFI, BPP.

1. Introduction

Motherhood is one of the most important landmarks in the life of a woman. Making this experience harmless and free of complications is the goal of any obstetrician. Despite this nearly 830 women die every day from preventable causes related to pregnancy and childbirth [1]. Globally, perinatal mortality rate is 47 per thousand, however, in India this rate is nearly 25 per thousand [1]. Amidst these high maternal and perinatal death rates, the maternal and neonatal morbidity are the biggest challenges before an obstetrician [2]. The chance of complications during pregnancy is dependent on a host of individual, environmental and circumstantial factors. Based on an interaction of individual and environmental characteristics, certain pregnancies are termed as high risk pregnancies. The high risk pregnancies in turn indicate a potentially increased risk of adverse events during the pregnancy. Technically, a high-risk pregnancy refers to anything that puts the mother, fetus, or neonate at increased risk for morbidity or mortality during pregnancy or childbirth [3-5].

High risk pregnancies are pregnancies often complicated by pre-eclampsia, eclampsia, anemia, oligohydramnios, etc. The management of high risk

pregnancies includes a thorough monitoring and timely intervention in order to avert any adverse outcome. The unfavorable outcome could theoretically be pre-empted by well-timed induction of labour and delivery of a healthy infant. Using a proper surveillance system, the unfavorable outcome during labour could be averted. However, a disconcerting feature of induction of labour is that it may cause an increase in Caesarean section rates [6-8]. Furthermore, selection of patients for induction of labour is hampered by uncertainty relating to gestational age. There is a distinct lack of prospective randomized studies clearly demonstrating advantages of induction of labour. The benefit of reducing a potential fetal risk with induction of labour must be balanced against the morbidity associated with the procedure and hence the relevance of a surveillance system to identify the potential risk gains more significance.

Common methods for fetal surveillance include fetal movement counting, non-stress test (NST), biophysical profile, modified biophysical profile (NST and amniotic fluid volume estimation) and contraction stress test. Biophysical profile/Modified biophysical profile uses the combination of non-stress test and sonographic evaluation of amniotic fluid. Has a high specificity and high negative predictive value and has been shown to be an effective decision tool [9].

The fetal biophysical profile is one of the most widely accepted tests for the evaluation of fetal well-being in high risk cases. The original biophysical profile was described by Manning *et al* and 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 scoring is cumbersome, time consuming and expensive [10-13].

Nageotte *et al* reported that the fetal biophysical profile based on NST and AFI findings and termed it as modified biophysical profile (MBPP) [14]. MBPP combines Non-stress test (NST) as a short term marker of fetal status and the amniotic fluid index (AFI) as a marker of long term placental function and is easier to perform and less time consuming than complete biophysical profile, moreover it is considered to be as effective as complete biophysical profile [14]. Considering the stated benefits of modified biophysical profile in prediction of complications or distress during labour, the present study was carried out to evaluate the role of modified biophysical profile in high risk pregnancy and fetal outcome.

2. Material and Methods

The present study was carried out at the Department of Obstetrics and Gynaecology, Maharani Laxmi Bai Medical College, Jhansi among a total of 125 high risk pregnancies with gestational age >34 weeks. High risk was ascertained by presence of one or more of the following factors, viz., age >35 years, IUGR, postdated pregnancy, GDM, hypertension – chronic/PET, decreased fetal movements. At admission detailed history was taken and general, systemic and obstetrical examination was carried out. A note was made for presence of other maternal complications like history of stillbirth, poor weight gain during pregnancy, thyroid disorder, cardiac disease, renal disease, Rh incompatibility and anemia.

Modified biophysical profile (non-stress test and amniotic fluid index) was obtained for all the patients. Non-stress test (NST) was done using Hunteigh's foetal monitor. A reactive test was marked when two or more fetal heart rate accelerations were recorded during the 20 minute period. Each acceleration of 15 or more beats per min and lasting for 15 or more seconds usually occurred simultaneously with episodes of fetal activity.

If no spontaneous fetal movement occurred during the initial 20 minutes observation, the test was continued for another 20 minutes. If there was no acceleration during 40 minutes, the test was considered non-reactive.

Amniotic fluid index was measured using real time ultrasound scanning after the completion of non-stress test and consisted of a general survey of intrauterine contents and fetal presentation. Then a four quadrant amniotic fluid volume was assessed by placing a linear ultrasound transducer perpendicular to the wall of the uterus and parallel to the mother's spine in four abdominal quadrants. Pockets consisting primarily of umbilical cord were discarded. A four quadrant sum of 5 or greater was considered normal.

Patients were tested twice a week till delivery. When the NST was non-reactive and AFI was <8, patient was considered for delivery. Patients with normal test results were allowed to begin labour spontaneously except when delivery was indicated for maternal or obstetric complications. Only the last antenatal test within seven days of delivery was considered for analysis. All the patients were watched during labour and fetal outcome was noted in terms of – meconium stained liquor, Apgar score at 5 min, need for NNU admission and perinatal death. All the data was compiled and analyzed using Statistical Package for Social Sciences, version 20.0. Chi-square test was used to compare the data.

3. Results

Age of patients ranged from 19 to 35 years with a mean age of 24.32±4.37 years. Mean gestational age at enrolment was 35.23±1.78 weeks. A total of 41 (32.8%) patients had AFI<8. Non-reactive NST was seen in 52 (41.6%) patients. Overall abnormal biophysical profile (NR-NST/AFI<8) was seen in 62 (49.6%) patients (Table 1).

Overall incidence of meconium stained liquor, Apgar<7 at 5m, NNU admission and NNU expiry was 15.2% (n=19), 20.8% (n=26), 26.4% (n=33) and 4.0% respectively. Non-stress test showed a statistically significant association with outcomes MSL, Apgar<7 at 5 min, NNU admission and neonatal death. However, low AFI showed a significant association with MSL, Apgar <7 at 5 min and NNU admission only. Overall biophysical profile abnormality showed a significant association with all the adverse fetal outcomes being studied (Table 2).

For MSL, AFI and NST showed a sensitivity & specificity of 57.9% & 70.9% and 78.9% & 65.1% respectively whereas biophysical profile abnormality was 89.5% sensitive and 57.5% specific. For low Apgar at 5 min, AFI was 57.7% sensitive and 73.7% specific whereas NST was 76.9% sensitive and 67.7% specific. Overall biophysical abnormality was 96.2% and 62.6% sensitive for low Apgar and for NNU admission; AFI was only 54.5% sensitive and 75% specific whereas NST was 78.8% sensitive and 71.7% specific. Overall biophysical abnormality was 84.8% sensitive and 63% specific for NNU expiry; AFI was only 60% sensitive and 68.3% specific whereas NST was 100% sensitive and 60.8% specific. Overall biophysical profile abnormality was 100% sensitive and 52.5% specific (Table 3).

Table 1: Baseline Characteristics and Biophysical Profile of patients

Characteristic	Statistic
Mean Age	24.32±4.37 (19-35)
Mean GA at enrolment	35.23±1.78 Weeks
AFI Status	
<8	41 (32.8%)
≥8	84 (67.2%)
Non-reactive NST	52 (41.6%)
Abnormal Biophysical profile	62 (49.6%)

Table 2: Association of Biophysical profile with fetal outcome in high risk pregnancies

Fetal Outcome	Abnormal		Normal		Statistical significance
	No.	%	No.	%	('p' value)
NST					
	Abnormal (n=52)		**Reactive (n=73)**		
MSL (n=19)	15	28.8	4	5.5	<0.001*
Apgar <7 at 5m (n=26)	23	88.5	3	11.5	<0.001*
NNU Admission (n=33)	26	50.0	7	9.6	<0.001*
NNU Expiry (n=5)	5	9.6	0	0	<0.001*
AFI					
	Low AFI (n=41)		**Normal AFI (n=84)**		
MSL (n=19)	11	26.8	8	9.5	0.011*
Apgar<7 at 5m (n=26)	15	26.8	11	13.1	0.002*
NNU Admission (n=33)	18	43.9	15	17.9	0.002*
NNU Expiry (n=5)	3	7.3	2	2.4	0.186
Biophysical Profile					
	Abnormal (n=62)		**Normal (n=63)**		
MSL (n=19)	17	27.4	2	3.2	<0.001*
Apgar<7 at 5m (n=26)	25	40.3	1	1.6	<0.001*
NNU Admission (n=33)	28	45.2	5	7.9	<0.001*
NNU Expiry (n=5)	5	8.1	0	0	<0.001*

*= Significant (p=<0.05)

Table 3: Predictive efficacy of AFI and NST for different fetal outcomes

Fetal Outcome	Sensitivity	Specificity	PPV	NPV	Accuracy
Meconium stained liquour					
AFI	57.9	70.9	26.8	90.1	68.9
NST	78.9	65.1	28.8	94.5	67.2
Biophysical profile	89.5	57.5	27.4	96.8	62.4
Apgar <7 at 5 min					
AFI	57.7	73.7	36.6	86.9	70.4
NST	76.9	67.7	38.5	91.8	69.6
Biophysical profile	96.2	62.6	40.3	98.4	69.6
NNU Admission					
AFI	54.5	75.0	43.9	82.1	69.6
NST	78.8	71.7	50.0	90.4	73.6
Biophysical profile	84.8	63.0	45.2	92.1	68.8
NNU Expiry					
AFI	60.0	68.3	7.3	97.6	68.0
NST	100.0	60.8	9.6	100.0	62.4
Biophysical profile	100.0	52.5	8.1	100.0	54.4

4. Discussion

In present study, both AFI as well as NST independently as well as in terms of biophysical profile showed a significant association with adverse fetal outcomes. In previous studies, role of AFI in prediction of adverse fetal outcome has been reported in both normal as well as high risk pregnancies [15, 16].

In present study, for low Apgar at 5 min, AFI was 57.7% sensitive and 73.7% specific. Similar to results of present study, Sultana *et al*, also reported it to be 57.1% sensitive and 51.3% specific for prediction of low Apgar score even when taking AFI<5 cm as the criteria. In present study, for MSL, AFI was 57.9% sensitive [17]. However, Tasneem *et al*, in term pregnancies found it to be 80.6% sensitive for thin/thick meconium [18]. Anand *et al*, in their study found it to be 62% sensitive for MSL. For, the outcome NNU admission and NNU death, AFI was 54.5% and 60% sensitive and 73.7% and 68.3% specific [19]. Similar to findings of present study, Agarwal *et al*, also found AFI to be only 66.7% sensitive for neonatal death [20]. All these observations show that low AFI despite having a significant association with different adverse fetal outcomes had low sensitivity, thus showing that its discriminant use is limited while identifying the adverse outcomes.

Contrary to this for all the outcomes, NST was more sensitive as compared to AFI, however, it lagged slight specificity. For outcomes MSL, Low Apgar, NNU admission and Neonatal death, NST had a sensitivity of 78.9%, 76.9% and 100% whereas the specificity for these outcomes declined slightly and reached at 65.1%, 67.7%, 71.7% and 60.8% respectively. In present study, for all fetal outcomes, NST was more sensitive as compared to AFI. In a similar study, Maurya and Kushwah, found NST to be more sensitive than AFI for all these outcomes except for perinatal death for which both the predictors were 100% sensitive [21]. However, similar to our study Anand *et al* in their study also showed that NST had a higher sensitivity as compared to AFI (87.9% as compared to 48.5%) for the outcome low Apgar [19]. For the outcome MSL too, the sensitivity of NST was higher as compared to AFI (83.9% vs 35.5%). NST is a direct test reflective of fetal well-being and hence it is more sensitive for any adverse outcome. The usefulness of both AFI and NST lies in the decision making for any intervention, viz. induction in order to minimize the adverse outcome, thus their sensitivity is more important. Using a combined biophysical profile we could achieve a high sensitivity for all the fetal outcomes.

The success of biophysical profiling in high risk pregnancy does not only restrict to identification of such pregnancies but also on averting the adverse outcome by timely intervention. In fact, a recent meta-analysis, rated the evidence supporting the use of biophysical profile in fetal monitoring of high risk pregnancies to be insufficient [22].

However, the findings of present study strengthen the evidence in favour of biophysical profiling of high risk pregnancies and recommend further cumulative research on the issue.

5. Conclusion

Modified BPP was found to be useful in identification of adverse fetal outcomes, thus highlighting its role in planning interventions to avert extreme events.

Acknowledgments

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Conflict of interest

The author(s) confirm that this article content has no conflict of interest.

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