Original Article

Study Of Modified Biophysical Profile In Iugr And Correlation With Perinatal Outcome

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Abstract

BACKGROUND: Intrauterine growth restriction (IUGR) is one of the most common pregnancy complications and it substantially increases the risk of adverse neonatal outcome. Foetal biophysical profile is a well-established method of antepartum surveillance in IUGR patients. The present study was conducted to evaluate the role of modified foetal biophysical profile in IUGR pregnancies for predicting the perinatal outcome.

METHODS: This was a prospective observational study including 100 pregnancies affected by IUGR. Pregnant women with high risk factors leading to IUGR in ANC OPD admitted in ward or in emergency in Dept. Obstetrics and Gynaecology in tertiary care hospital, Hyderabad, who fulfilled the inclusion and exclusion criteria were enrolled for the study. Written, informed, valid consent was taken in the language they best understood. Patients were divided into 4 groups NST and AFI both were normal in 67 cases (Group A). NST was normal and AFI was abnormal in 22 patients (Group B). AFI was normal and NST was abnormal in 5 patients (Group C). Both parameters were abnormal in 6 patients (Group D).

RESULTS: out of the 67 patients with adequate AFI and reactive NST, 19 (29%) babies had perinatal morbidity.14 (63.6%) out of 22 patients with inadequate AFI and non-reactive NST had perinatal morbidity. 4 (80%) out of 5 patients with non-reactive NST but normal AFI had some type of perinatal morbidity. While 3(50%) out of 6 patients with non-reactive NST with abnormal AFI had perinatal morbidity (P =0.014). Out of 100 babies, 17 (61%) of those with inadequate AFI has perinatal morbidity, while 23 (32%) with adequate AFI had the same (P<0.01).
CONCLUSION: Modified biophysical profile (MBPP) is easier, less time consuming, cost effective and patient compliant test and hence, can be used as a primary antepartum fetal surveillance test to predict perinatal outcome and provide timely intervention in IUGR pregnancies.

Keywords: Pregnancy, Perinatal outcome, Biophysical profile

INTRODUCTION

Intrauterine growth restriction (IUGR) is one of the most common pregnancy complications and it substantially increases the risk of adverse neonatal outcome. IUGR represents pathological inhibition of fetal growth and failure of the fetus to attain its growth potential. It has been estimated that in developing countries, approximately 30million newborns are affected with intrauterine growth restriction per year. This rate is six times higher than that in developed countries. There is a strong association between stillbirth and foetal growth restriction. Among all stillbirths, 20% are found to be due to IUGR. The sequelae of IUGR include stillbirth, detrimental effects on neuro-developmental progress in childhood and higher risks of diseases like hypertension, vascular disease and diabetes in

adulthood. Therefore, these pregnancies need to be monitored closely to identify at risk fetus and initiate delivery before this critical event.

Foetal biophysical profile is a well-established method of antepartum surveillance in IUGR patients.

Classical biophysical profile was described by **Manning et al**.,[1] It includes 5 parameters- foetal tone, breathing movements, gross body movements, amniotic fluid volume, and non-stress test. Hence, it's more time consuming, cumbersome and expensive. Modified biophysical profile (MBPP) was first described by **Nageotte et al.,** [2] It includes Amniotic Fluid Index (AFI) and non-stress test (NST). AFI is a marker of long-term placental function and NST is a marker of short-termfoetal condition. MBPP is hence less time consuming and easier to perform.

Hence in this study modified biophysical profile is used as a primary marker for foetal surveillance in FGR and its perinatal outcome. Objective of present study was to evaluate the role of modified foetal biophysical profile in IUGR pregnancies for predicting the perinatal outcome.

METHODS: This was a prospective observational study including 100 pregnancies affected by IUGR. Pregnant women with high risk factors leading to IUGR in ANC OPD admitted in ward or in emergency in Dept. Obstetrics and Gynaecology in tertiary care hospital, Hyderabad, who fulfilled the inclusion and exclusion criteria were enrolled for the study. Written, informed, valid consent was taken in the language they best understood. Detailed history of the pregnant women was taken and thorough clinical examination including vital parameters, systemic examination, and obstetric examination was done and all routine investigations were done. The patients with IUGR were evaluated with modified biophysical profile from 34 weeks onwards with Non stress test (NST) for 20 mins and Amniotic Fluid Index (AFI) with 4 quadrant technique. NST was performed in supine position and foetal heart sound, foetal movements, uterine contractions, if any were recorded. NST was considered reactive if more than two foetal movements with accelerations of more than 15 beats/ minutes lasting for more than 15 seconds with good beat to beat variability with no decelerations are seen in 20 mins. If NST was not reactive, the foetus was stimulated with VAST (Vibro Acoustic Stimulator) and the NST was repeated. If the result is still not reactive for 40mins, it was labelled a non-reactive NST. Real time ultrasound was done and AFI was calculated by the four-quadrant technique. As described by **Phelan et al.,**[3] AFI was considered abnormal if less than or equal to 5 and more than or equal to 25. Patients were followed up till delivery and perinatal outcome was assessed and attributed to the last MBPP before delivery.

Reactive NST

• Baseline 110-150 bpm

• Amplitude baseline variability of 5-25bpm

• Two or more accelerations of 15bpm lasting for 15secs

• Absence of decelerations.

Non-Reactive NST

• Baseline less than 100 or above 170

• Baseline variability of less than 5 bpm

• Sinusoidal pattern

• Repeated, prolonged and severe variable decelerations

• Periodically occurring repeated late decelerations.

Perinatal outcome in cases of

• Normal AFI and NST

• Normal AFI but non-reactive NST

• Reactive NST but abnormal AFI

• Abnormal AFI and Non-reactive NST

Inclusion criteria

Singleton pregnancies with cephalic presentation with gestational age of 34wks or more with diagnosed IUGR.

Exclusion criteria

• Featuses with congenital anomalies

• Intrauterine deaths

• Multifetal pregnancies

Placenta previa

Patients in Active labour

Systemic diseases (Anaemia , Diabetes, thyroid disease, heart disease, Preeclampsia)

Parameters to be assesed

• Mode of delivery

• Nature of liquor

• Foetal distress

• Apgar at birth

• Need for neonatal resuscitation

• Perinatal morbidity

For study purpose, Patients were divided into 4 groups NST and AFI both were normal in 67 cases (Group A). NST was normal and AFI was abnormal in 22 patients (Group B). AFI was normal and NST was abnormal in 5 patients (Group C). Both parameters were abnormal in 6 patients (Group D).

Statistical analysis

A descriptive statistic i.e., frequencies and percentages was calculated. Chi square test was used to test the associations between the variables. Binary logistic regression was applied to measure the risk associated with

modified biophysical profile. Z test (proportion test) was used to find significant differences.

RESULTS

The patients were categorized according to the gestational age in weeks; it was found that 20% of the cases were between 34-36 weeks. 32% of the cases were between the gestational ages of 38-40 weeks. Majority of the cases were above 40 weeks of gestation. Those who were above 40 weeks, all were prolonged, none were post term.

Figure 1: Weekly follow up of MBPP

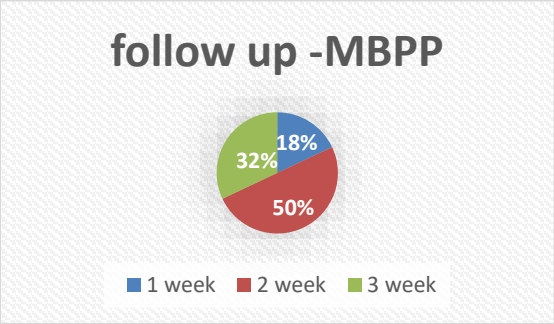


Figure 1 shows that out of the 22 follow up cases, majority of them, 11 cases (50%) had followed up weekly for two weeks, while 7 (31.8%) had weekly follow up for 3 weeks. 4 cases (18.2%) had a MBPP one week before delivery.

Figure 2: Type of Labour

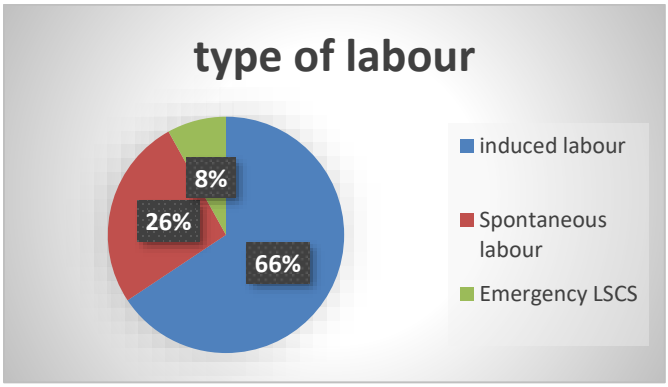
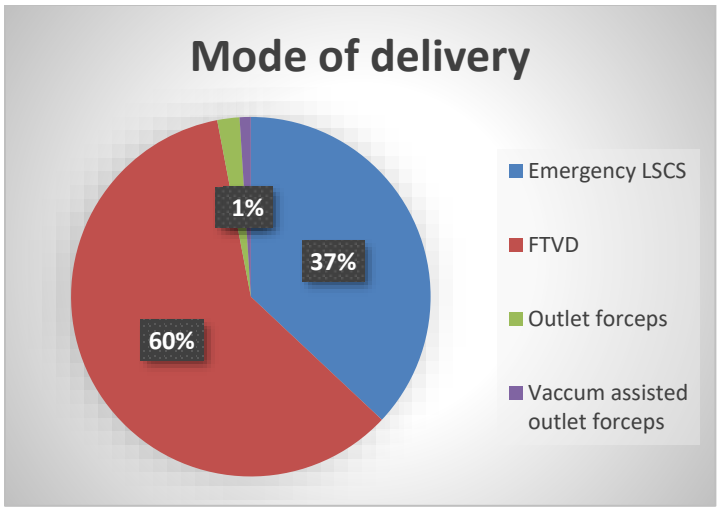


Figure 2 Out of the 92 patients who were given trial of labour, 60 cases (65%) were induced while 24 patients (26%) had spontaneous onset of labour. 8 (8%) patients were taken up for emergency LSCS directly due to non-reactive NST.

Figure 3: Mode of delivery



Total is 38 as 1 patient had intrapartum fetal distress and also meconium-stained liquor.

Figure 3 says of 100 patients 63 of them had vaginal delivery and 37 of them had emergency caesarean section. Out of the 63 patients who had vaginal delivery 60 of them had full term normal delivery, 2 of them had Outlet Forceps, while 1 had vacuum followed by outlet forceps.

Figure 4: Indication for LSCS

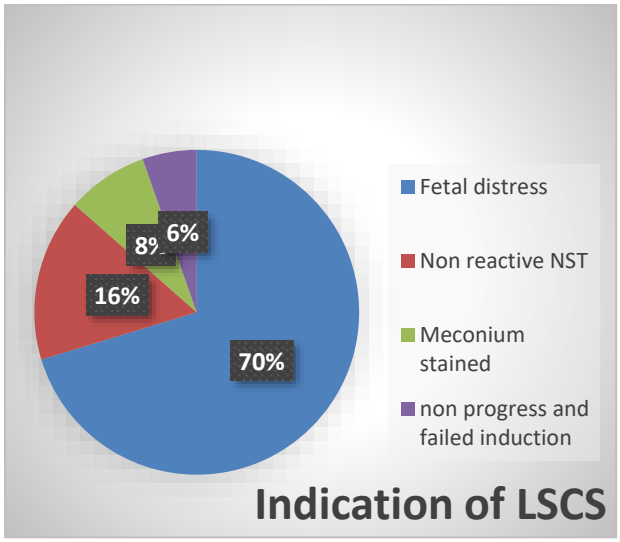
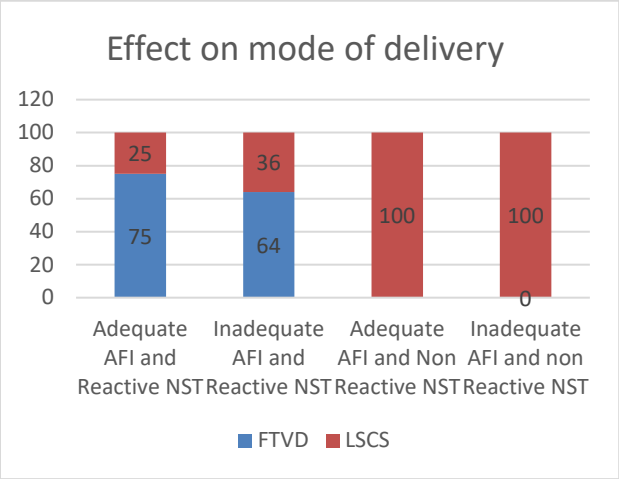


Figure 4 shows that of the 37 cases who underwent caesarean section, 29 were given trial of labour while 8 were taken up for emergency LSCS for non-reactive NST with/without oligohydramnios and without trial of labour. 25 of them (66.5%) had intrapartum fetal distress while 8 patients (20.5%) had their indication as non reactive NST. 3 patients (8.1%) had meconium-stained amniotic fluid as their indication. One patient (2.7%) hadnon progress of labour while one (2.7%) had failure of induction as their indication. Total is 38 as 1 patient had intrapartum fetal distress and also meconium-stained liquor.

MBPP and mode of delivery

Amongst 67 patients with normal MBPP, 49 (74.2%) patients had vaginal delivery while 18(25.5%) patients had LSCS. While, out of 33 patients with abnormal MBPP, 13 (41%) had vaginal delivery but 20 (59%) patients needed LSCS, p<0.01.

Figure 5: Individual parameters of MBPP and its effect on Mode of delivery



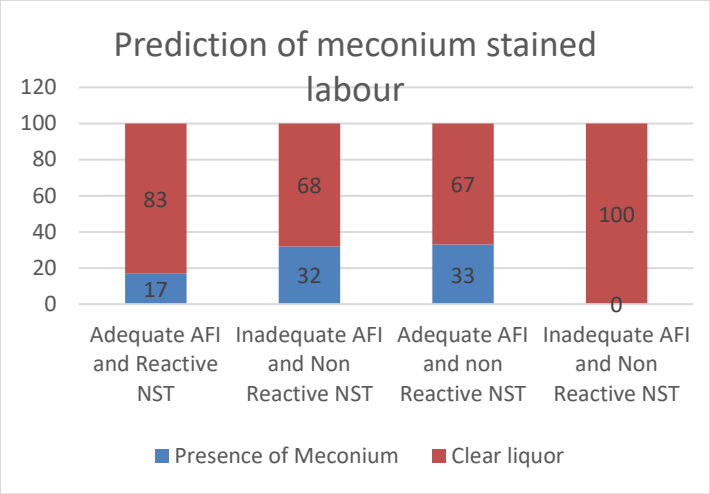
Among the modified biophysical profiles done in 100patients, when both parameters (NST and AFI) were normal (67 patients) 17(25.5%) patients underwent LSCS and 49(74.2%) patients had vaginal delivery (Figure 5). When both parameters were abnormal (6 patients) all 6 (100%) patients underwent LSCS. When NST was normal and only AFI was abnormal (22patients), 8(36.3%) patients had vaginal delivery & 14.3(63.6%) of them underwent LSCS. When AFI was normal and NSTwas abnormal (5 patients) all 5 patients (100%) underwent LSCS (P<0.01).

MBPP and presence of meconium-stained liquor

When the MBPP was normal, out of 67 patients 11(17%) patients had thick meconium-stained liquor; while whenMBPP is abnormal 9 out of 34 (26%) patients had meconium-stained liquor (P value -0.29).

Figure 6 out of 100 patients' meconium staining of liquor was observed among 20 cases (12 thick and 8 thin). When both parameters (NST and AFI) were normal out of 67 patients, 11 (17%) patients had thick meconium-stained liquor, when both parameters were abnormal out of 6, no patient had meconium-stained liquor. When NST was normal and AFI was abnormal, 7 (32%) patients of 22 had meconium-stained liquor and when AFI was normal and NST was abnormal 2 (32%) patients had thick meconium-stained liquor of 5 patients (P value -0.21). Out of 100 patients, 92 patients had trial of labour, while 8 directly went in for LSCS. Intrapartum foetal distress was observed among 31 cases. 25 patients had LSCS while 6 delivered vaginally. 26 patients had latedecelerations, 3 had variable decelerations while 2 had persistent foetal tachycardia.

Figure 6: Last MBPP and its role in predicting Meconium-Stained liquor



MBPP and intrapartum fetal distress

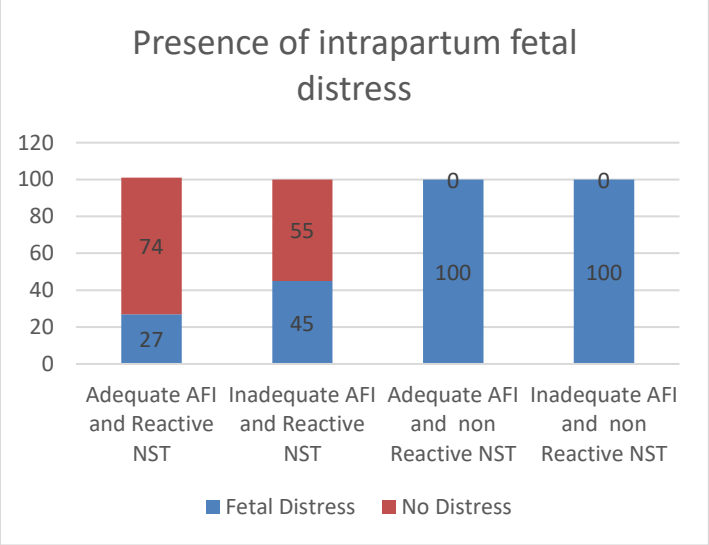


Figure 7: Individual components of MBPP and presence of intrapartum fetal distress.

When MBPP was normal, 18(27%) out of 67 patients had intrapartum fetal distress, while in those it was abnormal, 13 out of 25(52%) had fetal distress (P<0.01).

Figure 7shows when both parameters (NST and AFI) were normal out of 67 patients, 18(27%) patients had intrapartum fetal distress, when both parameters were abnormal out of 1 patient was given trial of labour and she developed intrapartum fetal distress (100%). When NST was normal and AFI was abnormal, 10 (45%) patients of 22 had intrapartum fetal distress. When AFI was normal and NST was abnormal 2 patients were given trial of labour and both (100%) patients had intrapartum fetal distress (P<0.01).

MBPP and APGAR score

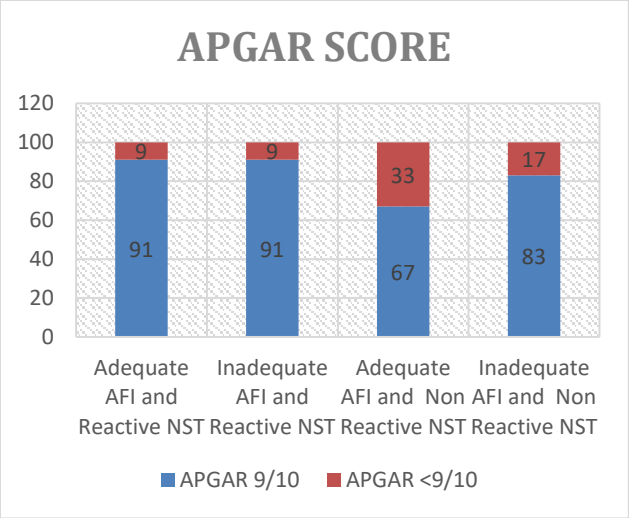


Figure 8: Individual components of MBPP and APGAR score.

Those with a normal MBPP 6 out of 67 patients had APGAR <9 (9%), While 5 out of 33 with those of abnormal MBPP had APGAR <9 (14.2%) (P<0.69).

Among the 100 cases included in the study, APGAR score of <9 was observed among 11 cases (Figure 9). When both parameters (NST and AFI) were normal 6 (9%) patient had APGAR score of <9, when both parameters were abnormal 1(16%) patient had APGAR score of <9 out of 6, when NST was normal and AFI was abnormal 2(9%) of the 22 patients had APGAR score of <9 and when AFI was normal and NST was abnormal 2(33%) patients had APGAR score of <9 out of 5 (P -0.32).

Neonatal outcome

Out of the 11 babies with APGAR <9/10, 8 babies had APGAR 8/10. Only 1 NICU admission in view of meconium aspiration syndrome was done, who was discharged on day 3. All other babies cried on resuscitation and were with their mothers.3 babies had APGAR <8/10. They needed NICU admission for 4-5 days but were discharged without any neurological deficit.

MBPP and need for neonatal resuscitation

Resuscitation was needed for 40 out of the 100 babies born. Stimulation followed by suctioning was needed in 19 (47.5%) while 21(52.5%) babies needed intratracheal suctioning.

When the MBPP is normal, 17 (24.2%) out of 67 babies needed resuscitation while 24(70.5%) out of 34 babies with abnormal MBPP needed resuscitation P<0.01.

Figure 9 explains that among the 100 cases included in the study, neonatal resuscitation was needed by 40 babies. When both parameters (NST and AFI) were normal 17 (24%) babies needed resuscitation, when bothparameters were abnormal 3 (50%) of 6 babies needed resuscitation, when NST was normal and AFI was abnormal, 17(77%) of the 22 babies needed resuscitation and when AFI was normal and NST was abnormal 3 (67%) of 5 babies needed resuscitation (p<0.01).

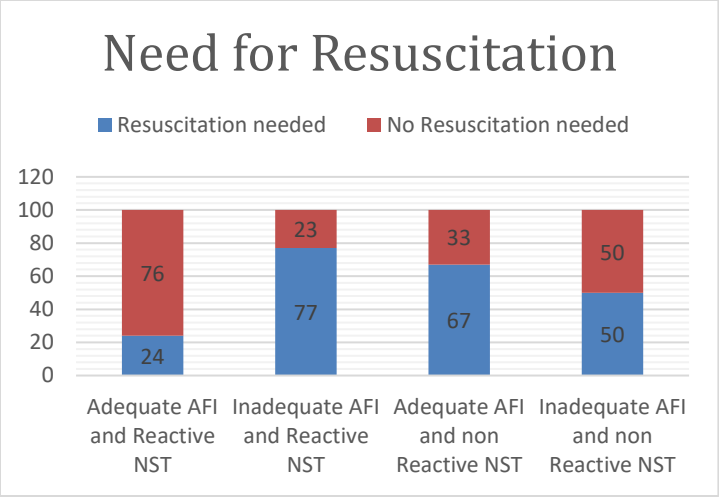


Figure 9: Individual component of last MBPP and need for neonatal resuscitation.

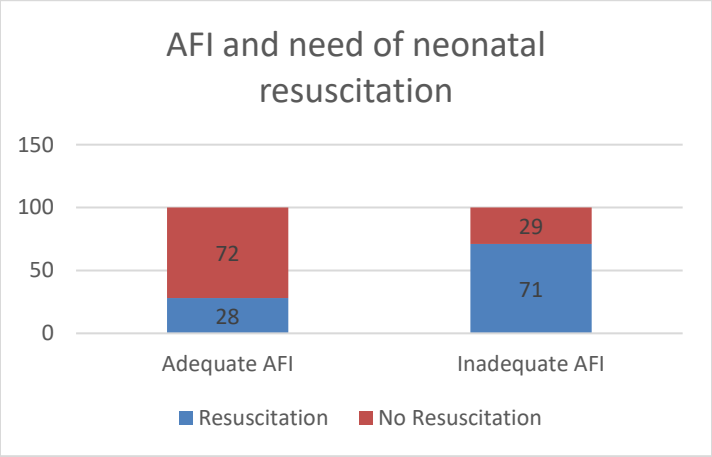


Figure 10: Last AFI and need of neonatal resuscitation.

Figure 10 shows 20 (27.2%) out of 72 babies with an adequate AFI needed resuscitation; while 20 (71.4%) out of 28 babies with inadequate AFI needed resuscitation after birth ($p<0.01$).

Neonatal outcome

4 babies with meconium-stained amniotic fluid needed NICU admission after intratracheal suctioning and had respiratory distress. Babies were given antibiotics and were discharged in 4-5 days. No neurological deficit. 2 babies with APGAR <6/10 needed IPPR for 3 – 5 minutes and were kept in NICU on CPAP. Both were discharged on day 5. No baby had any neurological deficit on discharge.

MBPP and perinatal morbidity

Out of the 100 babies born, 40 had perinatal morbidity. 8 babies had low birth weight, 10 had meconium aspiration syndrome and 22 had respiratory distress.

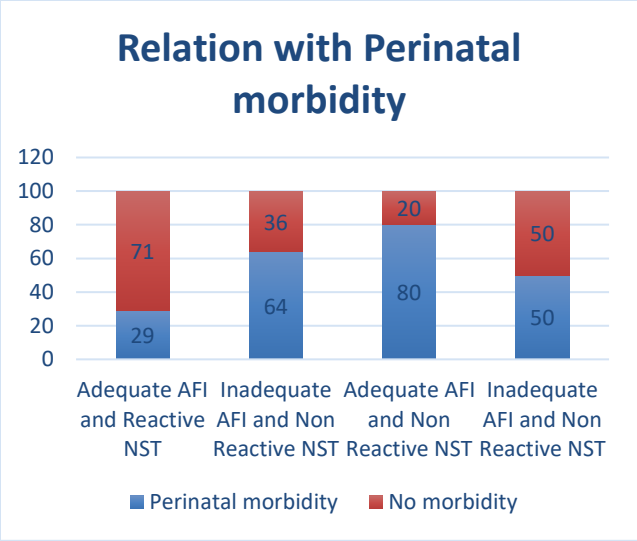


Figure 11: Individual component of MBPP and perinatal morbidity.

Out of the 67 babies with normal MBPP, 19 (28.7%) babies had perinatal morbidity while 21 (61.7%) out of 33 babies with abnormal MBPP had some perinatal morbidity (P<0.01).

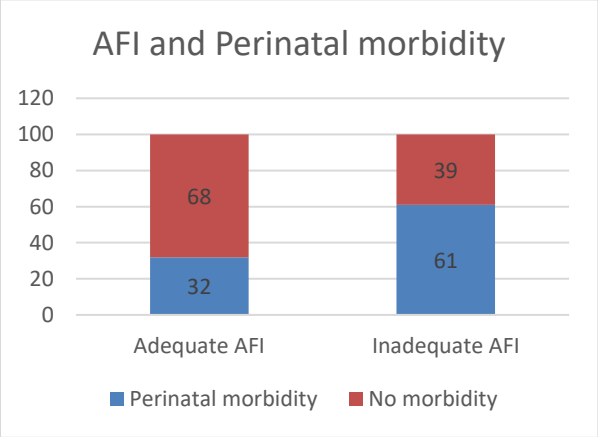


Figure 12: AFI and perinatal morbidity.

Figure 11 shows out of the 67 patients with adequate AFI and reactive NST, 19 (29%) babies had perinatal morbidity.14 (63.6%) out of 22 patients with inadequate AFI and non-reactive NST had perinatal morbidity. 4 (80%) out of 5 patients with non-reactive NST but normal AFI had some type of perinatal morbidity. While 3(50%)out of 6 patients with non-reactive NST with abnormal AFI had perinatal morbidity (P =0.014).

Figure 12 shows out of the all the 100 babies, 17 (61%) of those with inadequate AFI has perinatal morbidity, while 23 (32%) with adequate AFI had the same (P<0.01).

DISCUSSION

The risks of still births in prolonged pregnancy have been weighed against the complications of iatrogenic prematurity by induction of labour by **Edmunds et al.**[4] As majority of the cases were of prolonged pregnancy, MBPP can be used to asses fetal wellbeing and hence it can be used for timed induction of labour.

Figure1 as the fetal wellbeing is assured by MBPP, the gestational age of delivery can be optimised to prevent iatrogenic prematurity in IUGR. It shows that MBPP can be used for follow up of IUGR pregnancies to ascertain fetal wellbeing.

Figure 2 show that the number of patients in whom labour was induced were statistically significant. Thus, MBPP is rightly used for timed induction.Hence, can be used as a primary antepartum fetal surveillance test to predict perinatal outcome and provide timely intervention in IUGR pregnancies as also stated by **Donald et al**[5] and **Matsura et al**[6]

Figure 3, the rate of LSCS is higher than usual, but may be attributed to maternal high-risk factors.

Figure 4 shows that most common indication for LSCS in this study is Fetal distress either intrapartum or antepartum. Perinatal outcome is unfavourable in cases with non-reactive NST as stated by **Raouf S et al.**[7] Hence, continuous electronic fetal monitoring should be done in anticipation of fetal distress for cases with abnormal MBPP.

Table 1: Comparison of thick meconium staining of liquor with other study groups.

Studies	**No. of Patients (%)**	**P value**
Eden RD et al [8]	52(15.4%)	<0.05 S
Patil et al [9]	71(11.5%)	<0.05 S
Present study (100)	9(26%)	<0.05 S

Table 2: Comparison of incidence of LSCS for fetal distress with other study groups.

Studies	**No. of Patients (%)**	**P value**
Miller et al [10]	15(8.8)	<0.0001 S
Eden et al [9]	23(6.8)	<0.05 S
Nageotte et al [2]	155(5.6)	<0.0001 S

Present study	13(52%)	<0.001 S

Table 3: Comparison of 5-minute APGAR score of <9with other study groups.

Studies	No. of pts	P value
Nageotte et al [2]	13(0.8%)	Not Significant
Eden et al [9]	5(1.5%)	<0.001, S
Present study	5(15%)	<0.05 S

Figure 5 shows that the chances of LSCS in a patient withabnormal MBPP are statistically higher than in those withnormal MBPP. In this study it is seen that the rate ofcaesarean section is high when NST is abnormal. Hence, patients with abnormal MBPP should be meticulously monitored and delivered where services for emergency LSCS are available round the clock.

Figure 6 shows that chances of having meconium-stained liquor are more in cases of abnormal MBPP, but this correlation is not statistically significant in this study and needs further validation with a larger sample size. Also, no statistical relevance can be seen in the individual component of MBPP and presence of meconium.

The reference studies showed that there was significant meconium staining of liquor in cases of abnormal MBPP. In the present study, it showed that whenever the MBPP abnormal, we had 26% cases showing meconium which is also a significant value comparable to other studies.

Figure 7 shows that the presence of intrapartum fetal distress is significantly and statistically higher in cases with abnormal MBPP. The presence of intrapartum fetal distress is seen significantly in all cases of non-reactive NST who are given trial of labour. Hence, if patients with abnormal MBPP and even more with non-reactive NST are given trial of labour, they should be monitored with continuous intrapartum fetal monitoring so that fetal distress can be picked up at the earliest. In the study by Miller et al, the incidence of fetal distress 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**, [8] who has 15.8% fetal distress 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 also very high (52%) and statistically significant.

Figure 9 shows that the chances of baby having APGAR <9 are more when the MBPP is abnormal, but this is not statistically significant in this study. Also, the chance of a baby having APGAR <9 has no statistical significance depending on the individual component of MBPP. This may be because, most of the patients with abnormal MBPP went in for a LSCS without trial of labour and hence, the foetus had a favourable outcome.
15% patients with an abnormal MBPP had babies withAPGAR <9 in this study. Whereas in earlier studies, **Nageotte et al** [2] had 0.8% while Eden et al had 1.5%patients with abnormal MBPP having APGAR <9.3,13Present studies significant value is comparable with study of **Eden et al**.[8] Thus, the chances of the neonate needing resuscitation after birth are more when the modified BPP is abnormal and this difference is statistically

significant(Figure 9). The chance of the baby needing neonatal resuscitation more with inadequate AFI, and this difference is statistically significant in this study which is comparable to **Panda S et al.** [11] (Figure 10). Also, as AFI is a marker of long-term fetal condition, oligohydramnios is usually associated with need for neonatal resuscitation.

Hence, an obstetrician should consider delivering a foetuswith abnormal MBPP and more so with inadequate AFIin a centre with efficient facility for neonatalresuscitation.

Figure 11 shows that the perinatal morbidity is statistically more in patients with abnormal MBPP.

Figure 12, also shows the fetus with inadequate AFI have statistically more chances of having perinatal morbidity as AFI is a marker of long term fetal and placental condition which is comparable to **Kahkhaie K et al.**[12]. Hence, all fetus with with abnormal MBPP and more sowith oligohydramnios have to be delivered with centres with good perinatal care facilities, well equipped NICU and efficient neonatologists.

CONCLUSION

Modified biophysical profile (MBPP) is easier, less time consuming, cost effective and patient compliant test and hence, can be used as a primary antepartum fetal surveillance test to predict perinatal outcome and provide timely intervention in IUGR pregnancies. 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 foetus may be compromised. MBPP can help the obstetrician for appropriately timed induction so as to prevent iatrogenic prematurity and also safeguard neonatal outcome. MBPP can be used as an indicator to transfer the patient to an institute with intensive fetal monitoring availability, facility for emergency LSCS, well equipped NICU and skilled neonatologist availability.

Limitations of this study

• Small sample size. To formulate a definitive protocol, further multicentric studies with larger samples should be conducted.

• The NST component of MBPP has a high false positive rate.

• MBPP cannot reduce the perinatal morbidity due to low birth weight.

• The perinatal morbidity due to intrapartum fetal distress due to hyperstimulation of the uterus cannot be reduced by a pre-induction MBPP.

• Comparison between Manning's Score and MBPP is not done.

• The babies with perinatal morbidity have been followed up only till their hospital stay. Long term follow up is required to ascertain their development.

ACKNOWLEDGMENTS

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