



ROLE OF NON STRESS TEST AND UMBILICAL ARTERY DOPPLER VELOCIMETRY FOR ASSESSMENT OF FETAL OUTCOME IN HIGH RISK PREGNACY

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ABSTRACT

Aim: To compare the efficacy of Non Stress Test and Umbilical Artery Doppler velocimetry in assessing the fetal outcome in high risk pregnancy.

Materials and methods: In a prospective observational study, 100 pregnant women among the high risk group were monitored with Non Stress test and Umbilical artery Doppler velocimetry. The study consists of 25 women who underwent NST, another 25 for whom fetal Doppler was done and another 50 women for whom both NST and Doppler were conducted and followed up. All these three groups were followed up and compared. The fetal outcome was evaluated in all these three groups in terms of mode of delivery, colour of liquor, Apgar score and duration of NICU admission.

Results: The mean gestational age was 37.72 in Group I and 36.12 in Group II. The mode of delivery was predominantly LSCS among those women with abnormal NST alone (87.5%) and those with both abnormal NST and Doppler waveforms (100%). The Apgar score at 5 minutes was below 7 among 76% patients with abnormal NST. Meconium stained liquor was predominant among those patients with abnormal NST (50%). These differences were found to be statistically significant.

Conclusion: Screening of high risk pregnancies with both Doppler and NST was better than either test alone, because Doppler detected fetal compromise earlier than NST, giving a lead time which was more important in management of preterm pregnancies. Prognosis was best when both NST and Doppler were normal and worst when both the tests were abnormal. It was better to deliver the fetus before NST becomes abnormal. Disadvantages of Doppler over NST was the requirement of sophisticated equipment and also experienced persons were essential to perform the test.

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INTRODUCTION

Evaluation of antepartum fetal condition has become essential to obstetric care in both normal and complicated pregnancies. Many biochemical and biophysical assessment methods have been introduced during the past two decades. However, few have withstood the test of time better than fetal heart rate (FHR) testing. Thus, the need to develop methods to evaluate those foetuses at risk. Electronic fetal monitoring displays the fetal heart responses to intrinsic & extrinsic stimuli. High resolution dynamic ultrasound & Doppler imaging has the advantage to "see" the fetus, its environment & monitor fetal well

being. Doppler sonography makes it feasible to assess the fetal & uteroplacental circulations. The main purpose of these various antepartum surveillance techniques is to detect fetal distress so as to prevent fetal death. The idea of taking this study is to identify those foetuses that might be at risk in utero and provide prompt intervention in otherwise considered normal pregnancies without any obvious high risk factor. Thus, reducing both maternal and fetal morbidity and mortality. There has been no evidence however of a single test regarded as an exclusive choice for the fetal surveillance as they reveal different aspects of fetal pathology. Thus an attempt has been made to compare the efficacy of two surveillance tests: non stress

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test & umbilical artery doppler velocimetry and the combination of both in the ante partum surveillance of high risk pregnancy.

MATERIALS AND METHODS

This is a prospective type of study done in RMMCH between July 2013 – October 2015. After obtaining an informed consent from patient with at least one of the inclusion criteria recruited. They will be randomly allocated into two phases by a sealed envelope technique.

Phase I

- Patients are allocated into two groups *i.e.* One group screened by NST alone & the second group, with Doppler alone.

Phase II

- Patients will be screened by both NST & Doppler. Based on the results, they will be put into one of the following groups:
- Group A – both NST & Doppler are normal
- Group B – NST normal & Doppler abnormal
- Group C – NST abnormal & Doppler normal.
- Group D – both NST & Doppler abnormal.

Inclusion Criteria

Patients with gestational age 32weeks with

- Maternal hypertensive disorder.
- Gestational diabetes mellitus.
- Oligohydramnios.
- Suspected IUGR.
- Postdate pregnancy (patients who have crossed their due date)
- Patients with decreased fetal movements.

Exclusion Criteria

- Premature rupture of membranes (PROM)
- Multiple pregnancy.
- Intrauterine death (IUD)
- Known fetal CVS anomaly.

METHODOLOGY

Group I patients undergo NST alone

- If NST is normal – the patient is screened subsequently with NST biweekly / weekly.
- If equivocal – AFI is measured & managed accordingly
- If abnormal – delivery is recommended.
- Group II patients are screened with Umbilical artery Doppler alone
- If normal – they are screened subsequently with the same technique weekly

- If resistance index is more than 0.7 - AFI is assessed & delivery is recommended.
- If there is AEDF / reversal of flow – delivery is recommended.

In phase II – patients were screened with both NST & umbilical artery Doppler

- If both normal – they are screened subsequently with NST.
- Non reactive NST / Doppler showed AEDF or reversal of flow –delivery is recommended.
- If Doppler showed increased RI >0.7 or PI > 1, NST is performed – delivery is recommended if the NST is reactive.
- If NST is reactive, patient is followed up with NST / Doppler.

In both the phases, the mode of delivery & the indication for LSCS is noted. The fetal outcome is also evaluated depending on the colour of liquor, APGAR at 5 minutes, NICU at the time of admission & perinatal death. Result will be compared initially in both the phases I & II separately with the help of chi-square test. Finally results will be compared between the phases I & II.

RESULTS

In phase I, 50 patients were divided randomly into two groups of matched patients. Patients in Group I were screened with NST alone and Group II patients with Umbilical Artery Doppler alone. The results within 1 week of delivery were considered in the subsequent evaluation. There was no significant difference between the two groups while comparing the maternal age and parity, unlike the gestational age between the two groups. When comparing the mode of delivery and LSCS done for fetal distress. There was statistically no significant difference between the two groups. From this, we inferred that both the NST and Umbilical Artery Doppler pick up fetal distress with equal ease. But there was statistically significant difference while comparing Apgar <7 at 5 minutes (76% vs 44%), meconium stained liquor (28% vs 4%). But these results show that the Doppler picked up fetal compromise earlier in the stage of hemodynamic changes whereas NST picked up cerebral hypoxia which occur later.

Phase II of this study aimed to assess the efficacy of NST and Doppler done together. 50 patients were randomly allocated to undergo NST and Umbilical Artery Doppler. These patients were divided into the following groups based on the results of NST and Umbilical Artery Doppler

Group I – NST normal and Doppler normal
 Group II – NST normal and Doppler abnormal
 Group III – NST abnormal and Doppler normal
 Group IV – Both NST and Doppler abnormal

The age of these patients ranged from 19 to 35 years. The LSCS rates were 56% for Group I, 60% for Group II, 87% in Group III and 100% in Group IV. With both these tests

being abnormal, a risk of vaginal delivery was not thought to be prudent. There was statistically significant difference among the four groups in the present study.

There was statistically significant difference in the indication for LSCS which was fetal distress for 90% cases when both of these tests were abnormal; while LSCS was done for other indication for 55% of patients when both of these tests were normal.

Apgar < 7 at 5 minutes was 50%, 53.3%, 87% and 63.6% among for groups in the present study. The difference was statistically significant. The higher incidence of low Apgar scores in Group III could be attributed to meconium stained liquor in 50% of patients in this group. In spite of 100% LSCS in Group IV, 63.6% of the newborns in that group had Apgar <7.

NICU admission was 37.5%, 60%, 62.5% and 81.8% for four groups respectively. The difference among the four groups was not statistically significant.

Table 1 Comparison of mode of delivery

Mode of delivery	Group		Total
	GP I	GP II	
LSCS	19	20	39
Vaginal	6	5	11
Total	25	25	50

Chi-Square Tests

	Value	df	p value
Pearson Chi-Square	0.117	1	0.733(NS)

Table 2 Comparison of Apgar

APGAR	Group		Total
	GP I	GP II	
<5	1	2	3
06-Jul	18	9	27
>7	6	14	20
Total	25	25	50

Chi-Square Tests

	Value	df	p value
Pearson Chi-Square	6.533	2	0.038 (S)

Table 3 Colour of liquor

Liquor	Group		Total
	GP I	GP II	
Clear	18	24	42
Meconium	7	1	8
Total	25	25	50

Chi-Square Tests

	Value	df	p value
Pearson Chi-Square	5.357	1	0.021 (S)

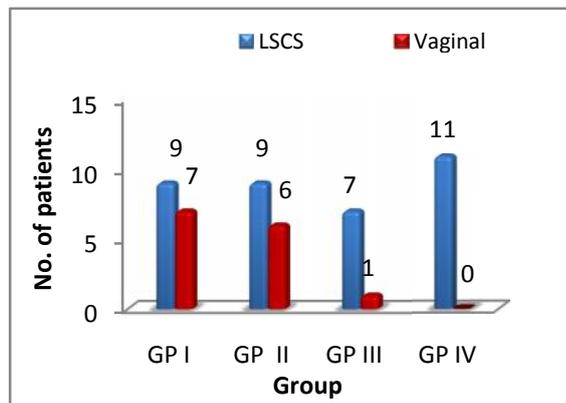


Figure 1 Comparison of mode of delivery (PHASE 2)

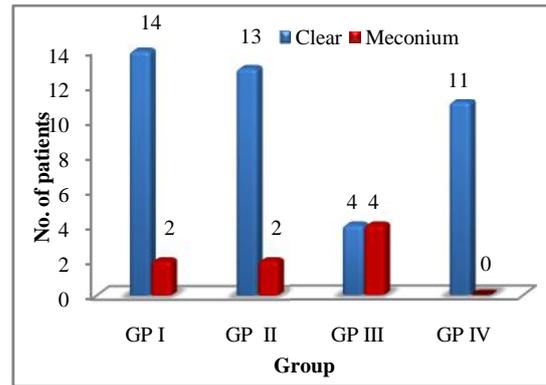


Figure 2 Colour of liquor (PHASE 2)

DISCUSSION

Lavanya Rai et al³ assessed and compared NST and Doppler with perinatal outcome and had a mean age of 27.7 (Range 20-38 yrs) in their study in 2006. The present study had a age range of 19-35 years which was comparable to the above studies. When compared between the 2 groups, GP I (NST) and GP II (Doppler), there was statistically significant difference in the 2 gps (P=0.823). In their study, 55 cases had a mean gestational age of 34 wks with a range of 30-38.4wks. There was no statistically significant difference between the reference study and the present study. Mean age was 38.2wks in group 1 NST and 37.4wks in Group 11 [Doppler]. There was no statistically significant difference between the two groups. However there was no statistical difference between the parity in Group I and Group II when they were compared in the present study. (P=0.91)

In the present study, the percentage of LSCS done for fetal distress was 48% and 29% in Group I (NST) and Group II (Doppler) respectively (TABLE 1). The results of the present study was comparable to the study done by Farmakides G et al². It can be inferred that NST and Umbilical Artery Doppler can both pick up fetal distress with equal ease. It can also be inferred that since NST indicate levels of fetal brain oxygenation and Umbilical Artery Doppler indicates the hemodynamic changes which occur due to fetal hypoxemia, both seems to occur almost simultaneously ie. fall in levels of fetal cerebral oxygenation occurs in tandem with hemodynamic changes due to fetal hypoxemia. To reevaluate its significance we further tested these 2 modalities in different combinations in phase 2.

In the present study Apgar <7 at 5 min was 76% and 44% for NST and Doppler groups respectively. These observations were similar to that of Williams et al⁴¹. If the 2 groups were compared in the present study there was a significant difference in the NST and Doppler groups (P=0.38) (TABLE 2)

The incidence of meconium stained liquor was 28% and 4% for NST group and Doppler group respectively. Thus significant difference between the 2 groups in the present study (P=0.021) (TABLE 3). There was no statistically

significant difference in the study done by **Williams et al**⁶ between the 2 groups and hence a statistical analysis between referral study and the present study was not attempted. There was no other referral study which evaluated the colour of liquor and hence a comparison between a referral study and the present study could be made. The difference between the 2 studies may be attributed to the comparative low hemoglobin concentration of the patients in the present study as compared to study done by **William et al**⁶. It may be summarised that low oxygen carrying capacity in some way precipitates a chronic hypoxic state resulting in meconium staining of the liquor. The difference between the 2 groups in both the studies were comparable and statistically significantly probably because NST picked up the deficiency in cerebral oxygenation and subsequent neurological stimulation resulting in earlier relaxation of anal sphincter resulting in meconium staining of liquor. Therefore NST group may have had a statistically significant difference when compared to the Doppler group. As Doppler reflected only hemodynamic changes rather than neurological changes.

In the present study NICU admission was 44% in NST group and 60% in Doppler group. The observations of the present study were comparable to studies done by **Almstrom H et al**¹ and **Farmakides G et al**². The difference between the observations of the present study and study done by **Williams et al**⁴¹ was due to larger sample size in the referral study. There was no statistically significant difference between the 2 groups in the present study.

The possible reason, for this difference was probably due to the fact that brain was more susceptible to minimal decrease in cerebral oxygenation and since NST picked up levels of cerebral hypoxia, the damage done was comparatively more severe, thus resulting in increased NICU admission.

In the study done by **William et al**⁴ fetal outcome as assessed by perinatal mortality was comparable to the present study. There was no fetal death in the Doppler group in referral study and in the present study.

Lavanaya et al³ had 45% in Group I 80% in Group II, 100% Group III, 56.2% in Group IV cesarean section rate. In the present study Group I had 56%, Group II 60%, Group III 87%, Group IV 100% cesarean section rate was observed. Though Groups I, II, and III were statistically similar to the referral study of **Lavanaya et al**³, in Group IV the difference was statistically significant. (100% in the present study as compared to 56.2% in the referral study) (**FIGURE 1**). This was probably because with both tests being abnormal a risk of vaginal delivery was not thought to be prudent in the present study. Hence all cases were taken for cesarean section. When comparing the mode of delivery between the groups **Lavanaya et al**³ had statistically significant difference in Groups I and IV. In the present study, the difference among all the 4 groups was statistically significant $P=0.041$ In the present study the indication of fetal distress for LSCS was 90% when both tests were abnormal, When both tests were normal, LSCS

was done for other indication in 55% patients. These results were comparable to the referral study. There was a statistically significant difference between the various groups in the present study $P=0.074$.

Higher incidence of fetal distress being the indication for LSCS was seen when NST results were abnormal. This was because NST was abnormal in the decompensation phase of fetal compromise which was a late sign as compared to Doppler changes which reflected the compensatory phase of fetal compromise indicating an earlier change.

Apgar <7 at 5 mins was 5%, zero, zero, 31% in GP I, II, III, IV respectively in the study done by **Lavanaya et al**⁵. In the present study Apgar <7 at 5 min was 50%, 53.3%, 87% and 63.6% among the four groups studied.

There was a statistically significant difference among groups between the present study and the referral study probably due to the fact that 80% and 100% were terminated by cesarean section indicating, a decision before fetal compromise. The significant point to note was that, in spite of 100% cesarean section in Group IV, 63.6% showed Apgar <7 indicating that Group IV had severely compromised fetuses which was picked up by the 2 tests and justifies the 100% incidence of cesarean section in these group in the present study.

Lavanaya et al³ had 40% of babies from group I, 73% from group II, 100% from group III, 85% from group IV admitted to NICU.

In the present study NICU admission was 37.5%, 60%, 62.5%, 81.8% for the 4 groups respectively. The results were comparable between the present study and the referral study for group I, II and IV. There was no significant difference in NICU admission rate in the present study. This could probably be attributed to the very small sample size in the group III in the study done by **Lavanaya et al**³. There was no statistically significant difference among 4 groups of the present study. [$P=0.065$] Meconium stained liquor was seen in 12.5% of the group I patients, 13.3% of group II, 50% of group III and none among group IV patients. There was no referral study where meconium stained liquor was considered in the observations. (**FIGURE 2**)

There was statistically significant difference among 4 groups in the meconium stained liquor ($P=0.027$). The significant observation in this table was though 50% showed meconium stained liquor in group III, the Apgar scoring indicating fetal compromise was above 80% again indicating that these 2 tests were able to detect severely compromised babies irrespective of meconium stained liquor.

Perinatal mortality in the study done by **Lavanaya et al**³ was 5%, 6%, zero and 50% among the four groups evaluated.

In the present study it was zero in 4 groups. Statistically significant difference between the present study and the

referral study in group I and II was due to the fact that there was 5% incidence of Abruption placenta in those groups in the referral study. The average LEAD TIME between abnormal Doppler and abnormal NST was 4.14 days in the study done by **Lavanya et al**³. In the present study it was 2.02 days. This was comparable to the reference study. This **LEAD TIME** was very important in preterm pregnancies as we gained time for the action of steroid given for prophylaxis towards pulmonary maturity.

CONCLUSION

- Screening of high risk pregnancies with both Doppler and NST was better than either test alone, because Doppler detected fetal compromise earlier than NST, giving a lead time which was more important in management of preterm pregnancies.
- Prognosis was best when both NST and Doppler were normal and worst when both the tests were abnormal. It was better to deliver the fetus before NST becomes abnormal.
- Disadvantages of Doppler over NST was the requirement of sophisticated equipment and also experienced persons were essential to perform the test.

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