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Original Article

Role of Non-stress Test in Antenatal Fetal Assessment in High-risk Pregnancy in Comparison with Normal Pregnancy

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Abstract

Background and Objectives: Non-stress test (NST) is one of the most widely used primary tests for the assessment of fetal well-being. It is a graphical recording of fetal heart activity and uterine contractions simultaneously and continuously when uterus is quiescent with fetal movements. It has been incorporated into biophysical profile system. It is simple, inexpensive, non-invasive, easily performed, and interpreted. Hence, it can be used to screen a large population as an outpatient department procedure. This study was done to observe the efficacy and diagnostic value of NST for antenatal surveillance and comparison of test results with mode of delivery and adverse perinatal outcome.

Materials and Methods: A total of 100 high-risk (HR) pregnant women (study group – selected based on inclusion and exclusion criteria) and 100 low-risk (LR) pregnant women (control group) were randomly enrolled into study and followed up with NST from 32 weeks of gestation and repeated at appropriate intervals in cases of the HR group.

Results: In the LR group, there was an increased incidence of intrapartum fetal death (IPFD), meconium-stained amniotic fluid (MSAF), and decreased liquor quantity in non-reactive (NR) subgroup compared to reactive NST (R-NST) subgroup. However, in the HR group, NR-NST was associated with significantly increased incidence of decreased liquor quantity, low Apgar score at 5 min of birth, and perinatal mortality compared to the R-NST subgroup. Although the statistical incidence of IPFD was not significant in the NR-NST subgroup compared to R-NST, it appeared clinically significant. MSAF incidence was not significant in these two NST result subgroups. Sensitivity, specificity, and negative predictive value of NST in the LR group were 100%, 81.8%, and 100%, respectively; likewise, in the HR group, they are 75%, 78.1%, and 98.7%, respectively, for perinatal mortality.

Conclusion: NST is a valuable screening test for detecting fetal compromise in both HR and LR fetuses that may have a poor perinatal outcome. Predictive value of NST for perinatal mortality was higher in the LR group compared to the HR group though statistically was not significant.

Key words: Antenatal surveillance, Apgar score, Biophysical profile, Decreased liquor quantity, High-risk pregnancy, Intrapartum fetal death, Meconium-stained amniotic fluid, Non-stress test, Perinatal mortality

INTRODUCTION

Advances in the perinatal care in the past 30 years have resulted in a dramatic decrease in perinatal mortality. These advances include improvements in the fetal surveillance techniques and technologic aspects of neonatal intensive care.

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With the introduction of electronic fetal heart rate (FHR) monitoring, ultrasound and most recently, the computerized fetal assessment, more specific and direct examination of the fetus has become a reality.

Modern-day investigations for monitoring fetal health and well-being (biophysical assessment) such as electronic FHR monitoring (non-stress test [NST] and contraction stress test [CST]), biophysical profile (BPP), and color Doppler help to identify the high-risk fetus and to adopt preventive measures to forestall an adverse perinatal outcome.[1]

The primary purpose of biophysical monitoring is to detect fetal hypoxia and acidosis, which are the common causes

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of fetal death. Hence, monitoring and initiating timely interventions are essential.

Increasingly sophisticated, non-invasive diagnostic instruments have made the intrauterine environment more accessible to the physician.

The early identification of the fetus at risk of preventable morbidity or mortality from uteroplacental insufficiency due to maternal risk factors, placental disorders, or fetal diseases has become a major goal of perinatal medicine.

In the mid-1970s, numerous authors noted the correlation between fetal well-being and accelerations of heart rate in response to fetal movements. Since then, antepartum FHR testing (AFHRT) has been and remains the primary mode of evaluating fetal status such as NST and CST.[2]

NST is a graphical recording of fetal heart activity and uterine contractions simultaneously in labor. It can also be recorded when uterus is quiescent along with fetal movements recording.

Simplistically, the NST is primarily a test of fetal condition and it differs from the CST, which is a test of uteroplacental function.[3] It is one of the most widely used primary testing methods for the assessment of fetal well-being and has also been incorporated into BPP system. It is not only simple and inexpensive but it is also non-invasive and easily performed and interpreted. It consumes less time and has no contraindications for testing. More importantly, it can be used to screen a large population quickly and can be performed by trained paramedical staff.

In this study, the effectiveness and the role of NST have been evaluated for assessing the perinatal outcome of fetuses in high-risk (HR) pregnancies.[3-6]

Objectives

The objectives of the study were as follows:

1 To evaluate the efficacy and diagnostic value of NST for antenatal surveillance in HR and low-risk (LR) cases
2. To compare the perinatal outcome with the test results.

MATERIALS AND METHODS

This prospective study was undertaken in M.N.R Medical College and Hospital, Sangareddy, Medak district from October 2011 to September 2013. Women with HR pregnancies were randomly enrolled into the study and followed up with NST from 32 weeks of gestation and repeated at appropriate intervals. A total of 100 HR patients (study group) and 100 LR patients (control group) were studied.

Inclusion criteria for selecting the study group were as follows:

1. Patients of all age groups
2. Singleton, non-anomalous pregnancies of 32 weeks or more weeks of gestation
3. Only NST performed within 7 days before delivery will be considered for the fetal outcome
4. Patients with clinically suspected or diagnosed cases of intrauterine growth restriction (IUGR), pre-eclampsia, chronic hypertension, diabetes mellitus, previous fetal demise, decreased fetal movements, severe anemia, third trimester bleeding, post-dated pregnancy, rhesus isoimmunization, premature rupture of the membranes, and advanced maternal age (>35 years) are included in the study.

The exclusion criteria for the study group include:

1. Sedative usage in the mother 24 h before testing
2. Major congenital anomaly of the fetus detected by routine antenatal ultrasound scanning

The patients were divided into study group of HR pregnancies and control group of LR pregnancies which did not have the above conditions. NST was used for their surveillance from 32 weeks of gestation. NST was recorded weekly, biweekly, on alternate days, or even daily basis depending on HR factors and was followed up. NST was recorded weekly in the LR group. The patient was placed in the left lateral recumbent position with a pillow under the hips to displace the weight of the uterus away from inferior vena cava. The patient's blood pressure and pulse rate were recorded every 10 min during the procedure.

The cardiotocographic equipment of BPL fetal monitor model FM 9533 was applied to the maternal abdomen and patient was instructed to push the event marker button every time she felt fetal movement.

An ultrasound transducer placed on the maternal abdomen was used to direct an ultrasonic beam toward the fetal heart. The transducers detect Doppler shifted frequency changes in echoes created by moving cardiac structures. An autocorrelation process is used to determine the time interval between successive cardiac cycles.

When the sound waves strike an object, they bounce back creating an echo. The monitor also makes use of another characteristic of sound called the Doppler principle which states that echoes reflected by the moving objects, differ from those reflected by the non-moving objects. This allows the monitor to recognize echoes from the fetal heart because of the heart's beating motion.

The monitor also uses this beating motion to compute the FHR. This is why the transducers must be properly positioned and use of ultrasonic coupling gel to send the sound waves toward the fetal heart to receive its echoes. The raw Doppler signals are processed with on board autocorrelation algorithms to yield trains of FHR intervals that generate a baseline rate.

External tocodynamometer device registers uterine activity by detecting the changes in the surface abdominal wall tension. These signals have been correlated with actual intrauterine pressure readings. Maternal conditions that distort abdominal contours (e.g., Marked obesity) decrease the ability of tocodynamometer to record uterine contractions. The paper that is used for recording is heat sensitive and consists of two panels. The upper panel shows FHR and the lower panel shows uterine activity.

The simultaneous recording was traced for 10 min and if there was no acceleration meeting the required criteria, vibroacoustic stimulus was given with an artificial larynx of approximately 80 Hz and 82 db for 1–3 s. The NST was recorded for 20 min and extended up to 40 min for the non-reactive (NR) traces.

The NSTs were classified into three groups based on the presence or absence of at least two FHR accelerations of 15 bpm lasting for 15 s in a 20 min reading into

1. Reactive or normal test
2. NR or abnormal test
3. Suspicious or equivocal test – In these cases, NST was done with vibroacoustic stimulation and extended to 40 min and the results were further classified as reactive or normal and NR or abnormal test based on the reactivity criteria.

One notable update in the ACOG guidelines (2008) is the three-tier classification system for FHR tracings (printouts of the FHR). Category 1 – FHR tracings are considered normal and no specific action is required. Category 2 – tracings are considered indeterminate. This category requires evaluation and surveillance and possibly other tests to ensure fetal well-being. Category 3 – tracings are considered abnormal and require prompt evaluation, according to ACOG. An abnormal FHR reading may require providing oxygen to the pregnant woman, changing the woman's position, discontinuing labor stimulation, or treating maternal hypotension, among other things. If the tracings do not return to normal, the fetus should be delivered.

The patients were then followed up till delivery/termination of pregnancy and the different variables of the perinatal outcome were noted. At the time of delivery, the following data variables were collected such as perinatal mortality, fetal distress during labor, and 5 min Apgar score. The end points used to judge the perinatal outcome include the following:

1. Perinatal death – intrapartum, immediate postpartum, or within the first 28 days of life
2. Fetal distress during labor – defined as an abnormal FHR (FHR <100 or >160) occurring during labor
3. A 5 min Apgar score of <7 – judged by an independent observer – a pediatrician. A 5 min Apgar score of <7 was considered as abnormal. Such newborn was immediately transferred to neonatal care unit
4. Meconium-stained amniotic fluid: The color of liquor during the labor was looked for and meconium staining of the liquor was noted
5. Decreased liquor quantity: The reduction in the amount of liquor appropriate for gestational age as noted by routine antenatal ultrasound examination and/or observed clinically during delivery
6. Cord factor – Any nuchal cords or cord presentations or abnormalities were noted.

Statistical Methods

Data recorded in the study have been subjected to appropriate statistical analysis. Chi-square test has been applied for comparison between the distribution of occurrences. To test the homogeneity of the groups with respect to the distribution of patients over different classes of a characteristic of interest, Chi-square (χ^2) test is carried out at 5% ($\alpha = 0.05$) level of significance. If $P < 0.05$, we conclude that the groups are heterogeneous and if $P > 0.05$, the conclusion is that the groups do not differ significantly, i.e., they are homogeneous.

RESULTS

This study included 100 HR and 100 LR pregnancies on whom NST was performed and those tracings were studied. They have been classified into the reactive and NR test groups based on the reactivity criteria. All the patients were followed up and were delivered in our hospital allowing the perinatal outcome variables to be obtained and analyzed.

The age distribution of patients in the HR and LR groups is tabulated in Table 1.

There was no statistical difference in the mean age between the two groups as $P > 0.05$. Hence, it is insignificant.

Parity distribution of the patients in both the LR and HR groups is shown in Table 2. Primigravida was observed more frequently in both the groups.

The patients in the HR and LR groups were classified based on the NST results into normal/reactive and abnormal/NR

test result categories. The incidence of abnormal test result was 24% in the HR group and 19% in the LR group, as shown in Table 3.

The patients in the LR and HR groups were followed up for mode of delivery. In the LR group, 33% of the patients underwent lower segment cesarean sections (LSCS), but in the HR group, the LSCS rate was as high as 72%.

In the LR group, 23% of cases were induced for labor while in the HR group, 15% of cases were induced for labor.

In the LR group, 27.2% of cases with reactive NST (R-NST) underwent LSCS and 57.9% of cases with NR-NST underwent LSCS.

In the HR group, 71.1% of cases with R-NST underwent LSCS, whereas 75% of cases with NR-NST underwent LSCS.

In the LR group, out of 33% of cases who underwent LSCS, 33.3% of them had NR-NST and 66.6% of them had R-NST.

Table 1: Age distribution of HR (*n*=100) and LR (*n*=100) pregnancy cases

Age (years)	LR group no. (%)	HR group no. (%)
18–20	24 (24)	27 (27)
21–25	63 (63)	51(51)
26–30	11 (11)	14 (14)
31–34	2 (2)	4 (4)
≥35	-	4 (4)

HR: High risk, LR: Low risk

Table 2: Parity-specific distribution of low-risk (*n*=100) and high-risk (*n*=100) pregnancy cases

Gravida	Low-risk group no. (%)	High-risk group no. (%)
Primigravida	52 (52)	55 (55)
Multigravida	48 (48)	45 (45)

Table 3: Distribution of cases in low-risk and high-risk groups based on mode of delivery

Mode of delivery	Low-risk group no. (%)	High-risk group no. (%)
Vaginal	67 (67)	28 (28)
Lower segment cesarean sections	33 (33)	72 (72)

Table 4: Distribution of cases in the low-risk and high-risk groups based on induction of labor

Induction	Low-risk group *n*=100 (%)	High-risk group *n*=100 (%)
Induced	23	15
Not-induced	77	85

In the HR group, out of 72% of cases who underwent LSCS, 25% of them had NR-NST and 75% of them had R-NST [Tables 4-7].

Neonatal Outcome Variables

The perinatal mortality rate and Apgar scores are tabulated in Table 8 for both the LR and HR groups. There were five perinatal deaths in all among 200 pregnant women studied; four of them occurred in the HR group and one in the LR group.

Among the LR patients, there was no perinatal death in the reactive test group while there was one in the NR test group which was statistically insignificant ($P > 0.05$). The incidence of low Apgar score was significantly more in the NR test group compared to the reactive test group.

The perinatal mortality rate in the HR group was 1.31% (1/76) in the reactive test group and 12.5% (3/24) in the NR test group which was statistically insignificant ($P > 0.05$). The incidence of low Apgar score was more

Table 5: Distribution of cases in the low-risk and high-risk groups based on mode of delivery and non-stress test results

Mode of delivery	Low-risk group *n*=100 (%)		High-risk group *n*=100 (%)	
	R (*n*=81)	NR (*n*=19)	R (*n*=76)	NR (*n*-24)
Vaginal	59 (72.8)	8 (42.1)	22 (28.9)	6 (25)
Lower segment cesarean sections	22 (27.2)	11 (57.9)	54 (71.1)	18 (75)

NR: Non-reactive, R: Reactive

Table 6: Distribution of cases in the low-risk and high-risk groups who underwent LSCS based on NST results

NST result	Low-risk group *n*=33 (%)	High-risk group *n*=72 (%)
NR	11 (33.3)	18 (25)
R	22 (66.6)	54 (75)

NST: Non-stress test, LSCS: Lower segment cesarean sections, NR: Non-reactive, R: Reactive

Table 7: Neonatal outcome variables: Perinatal mortality and Apgar scores observed in the low-risk and high-risk groups

Parameter	LR group			HR group		
	R (*n*=81)	NR (*n*=19)	Total	R (*n*=76)	NR (*n*=24)	Total
Low Apgar score	9	4	13	10	9	19
Perinatal mortality	0	1	1	1	3	4

NR: Non-reactive, R: Reactive, HR: High risk, LR: Low risk

significant in the NR test group compared to the reactive test group.

The predictive accuracy of NST for perinatal mortality is tabulated in Table 8. The sensitivity of NST for predicting perinatal mortality was found to be 75% in the HR group, while it was 100% in the LR group as there were no perinatal deaths in the reactive test group among the LR group. The specificity and negative predictive value (NPV) for perinatal mortality were 78.1% and 98.7%, respectively, among high-risk pregnancies. On the other hand, NST was very specific among LR patients and picked up all the cases of perinatal deaths making specificity 81.8% and NPV 100% with a false-negative rate of 0%.

To test the equality of predictive accuracy in the HR and LR groups, Chi-square test was carried out and it did not show any statistical significance in the predictive values among the LR and HR groups.

There was no statistically significant difference in predictive value among the two groups.

DISCUSSION

Among the various antenatal surveillance modalities used for HR pregnancies such as NST, CST, BPP, modified BPP, Doppler velocimetry, etc., NST is one of the easiest tests to perform and cost effective. There are considerable numbers of clinical literatures that support the use of NST in the management of HR pregnancies.[7-15]

In our study, 24% (24/100) of cases of HR pregnancies were NR while in the LR group, 19% (19/100) tests were NR. The percentage of NR tests in our study is almost similar to other studies, for example, Nochimson *et al.*, in his study, had 23.8% (187/786) NR traces.

Table 8: Predictive accuracy of NST for perinatal mortality

Perinatal mortality	Low-risk group (%)	High-risk group (%)
Sensitivity	100	75
Specificity	81.8	78.1
PPV	5.26	12.5
NPV	100	98.7
FP	18.1	21.9
FN	0	25

PPV: Positive predictive value, NPV: Negative predictive value, NST: Non-stress test, FN: False negative, FP: False positive

Perinatal Mortality

In our study, out of 100 LR cases, there was only one perinatal death in the NR test group and none in the reactive test group. While in 100 HR cases, there were four perinatal deaths of which three were seen in the NR test group. Hence, the sensitivity of NST in the LR group was 100% in predicting the perinatal mortality while the sensitivity in the HR group was 75%. The specificity and NPV of NST in the HR group for perinatal mortality in our study are 78.1% and 98.7%, respectively, while in the LR group, it is as high as 81.8% and 100%, respectively. On the other hand, the sensitivity and positive predictive value (PPV) are found to be 75% and 12.5%, respectively, in the HR group and 100% and 5.26% in the LR group.

This shows that a reactive test is an excellent indicator of a healthy fetus, especially in the LR group.

In our study, perinatal mortality occurred almost 3 times more frequently with an NR-NST result than with R-NST result in the HR group. As outlined in Table 8, fetal distress during labor was 3 times more likely to occur when fetuses entered labor with an NR-NST. As shown in Table 9, Phelan reviewed 3000 tests in 1236 HR pregnancies. He found a sensitivity and specificity rate of 64% and 81% for intrapartum fetal death (IPFD), while in our study, the same was 75% and 78.1%, respectively [Table 9].

False-negative NST

The false positivity and false negativity rates are affected by the sensitivity and specificity of the test and by the prevalence of the condition in the tested population. In our study, the false-negative rate was 25% in the HR group and 0% in the LR group for perinatal mortality. This false-negative rate can be as low as 1% in a 228 case study of Flynn *et al.* to as high as 49% in Brettchneider *et al.* study of 246 cases, but generally, it is <5–10%.

While a reactive test very accurately predicts a favorable outcome in the fetus, it actually reflects the low prevalence of poor outcome rather than precision of the test.

Table 9: Comparison of predictive value of NST for perinatal mortality with other studies

Criteria	Our study	Brown *et al.* (1981)	Phelan (1981)	Keegan *et al.* (1980)	Sood (2002)
Number of patients	100	343	1236	634	222
Reactivity criteria accelerations/minutes	2/20	5/80	4/20	2/20	2/20
Sensitivity (%)	75	50	64	33	54
Specificity (%)	78.1	99	81	90	90
False positive (%)	21.9	57	97	97	-

Further Evaluation of NR-NST

According to Keegan *et al.*,[11] the very high false-positive rates of NST could be diminished if there was a method of fetal stimulation by means of assuring the NR fetus. For this purpose, vibroacoustic stimulation was used in our study to arouse the sleeping fetus as well as extended the testing time to 40 min.

Brown *et al.*[8] found that the percentage of NR tests decreases if the observation period is extended in their study of 1101 tests in 343 HR pregnancies in which 24% of patients had NR tests in the first 20 min.

At 40 min, 5% had NR tests and by 80 min, only 2% had NR tests.

Some studies suggest that a reactive test encouraged continuation of pregnancy. On the other hand, Lenstrup and Hasse concluded that a pathological NST was not an indication for immediate delivery, but it was rather an indication for closed observation and should be considered in conjunction with the other clinical data of the particular pregnancy.

Evaluation of NST predictability has classically been based on the single last test usually within 7 days before delivery. The concept of serial comparison of test results was applied by Devoe *et al.*[11] in a series of 148 patients who had at least four NSTs before delivery, percentage acceleration time (PAT) was calculated and the fetus was used as its own control in sequential NSTs. Test sensitivity improved from 30% to 75% using PAT compared to conventional NST interpretation while the specificity was 100%, PPV 100%, and NPV 96.2%.

Graca *et al.* and Gelman *et al.* have repeated NR NST within 24 h after glucose drink or meal and have found an inconsistent effect on NST reactivity, while Keegan *et al.*[11] have suggested eliminating the possibility of drug ingestion.

Richardson *et al.* found an inconsistent effect of external physical stimulation such as suprapubic and fundal pressure on FHR while Leveno *et al.* immediately extended the NST recording to 80 min to improve the reactivity of NST.

NST Associated with Other Surveillance Modalities

Nochimson *et al.*[15] concluded that additional discriminatory evaluation was required for NR-NST. For this purpose, the CST was used, but it appeared that a more discriminatory test which will better indicate the loss of fetal well-being may be required. The need for a better test is based on the reports indicating a false-positive rate of CST which was approximately 25%. Devoe *et al.*[13] have reported on the use of NST, amniotic fluid assessment, and umbilical artery Doppler velocimetry in 1000 HR patients.

Each had specificity of >90% and sensitivities ranged from 69% (NST) to 21% (Doppler velocimetry). NPV of each method exceeded 85%. Amniotic fluid measurements or Doppler velocimetry compared with NST, appeared to be less powerful screening test when used alone.

Trudinger *et al.* compared AFHRT with the study of umbilical artery flow velocimetry waveforms for the recognition of fetal compromise in 170 patients considered to be at high fetal risk. Fetal compromise was effectively recognized by the study of umbilical artery waveforms. The sensitivity of assessment by umbilical artery waveforms was 60% compared to 17% and 36%, respectively, for two methods of scoring FHR traces.

Miller *et al.* used the modified BPP, in which NST serves as an immediate indicator of fetal well-being and amniotic fluid index (AFI) reflects the long-term adequacy of placental function. The false-negative rate of the modified BPP is lower than that of NST and compares favorably with false-negative rates of CST and complete BPP.

Ingermarsson *et al.* found that the patients with reactive admission test had a low rate of intrauterine asphyxia in labor (0.9%), whereas half of the patients with ominous traces had intrauterine fetal asphyxia with a low scalp pH and neonatal depression.

Some investigators have also used the NST to detect IUGR which is an outcome potentially more specific for uteroplacental insufficiency. The specificity and false-positive rates in a study of 590 HR women by Baskett *et al.* were 89% and 94%, respectively.

Schifrin *et al.* and Kubli *et al.*[7] have demonstrated good results with the use of NST in screening LR pregnancy as shown similarly in our study. In our study, the predictive value of NST for mortality was higher in the LR group compared to the HR group (but not statistically significant). However, the use of NST for LR patients will lead to an even greater number of false-positive results because of lower incidence of abnormality in LR population, but may increase inappropriate intervention.

According to Jonathan (2008) in his study, when otherwise healthy women with history of the previous stillbirth are followed with antepartum fetal testing, the stillbirth rate was 3.3 per 1000, suggesting that fetal testing can avert recurrent stillbirths.

Briscoe (2005), in his study, found that in post-term pregnancies, antenatal surveillance with fetal kick counts, non-stress testing, AFI measurement, and BPP is used although no data show that monitoring improves outcomes.

Erica and Thorp (2012) reported that fetal umbilical artery Doppler evaluation should be used for fetal monitoring in HR pregnancies thought to be at risk of placental insufficiency.

According to Ott (1999), the combination of the non-stress test and middle cerebral and uterine artery Doppler ratio was an excellent predictor of perinatal outcome. The middle cerebral and uterine artery Doppler improves the sensitivity for the prediction of poor perinatal outcome when it is combined with the NST.

Grivell *et al*. (2010) concluded that fetal assessment in current practice often involves a combination of methods which may reduce the relevance of the effectiveness of this single method of testing.

Yelikar (2013) concluded that the fetal compromise was greater when both Doppler and NST were abnormal. Moreover, when NST was abnormal, the fetuses were more compromised than when only Doppler was abnormal. This suggests that Doppler detects changes earlier than the NST. This was further validated by the time interval (lead time of 5.86 days) between an abnormal Doppler and an abnormal NST, wherein the Doppler changes preceded that of the NST.

CONCLUSION

The antenatal surveillance of HR pregnancies with NST can effectively screen for the identification of HR fetuses and segregate the population that is at risk for perinatal mortality and morbidity.

The potential advantage of NST is that a decrease in decision to delivery time can be made for those patients with fetal distress so that a major improvement in the outcome among parturients can be achieved with abnormal (NR) NST results.

The use of NST in monitoring HR pregnancies may result in an increase in the incidence of operative delivery as seen in our study (72% LSCS rate in HR pregnancies when compared to 33% in LR pregnancies), and hence, associated high LSCS rates have to be considered in such pregnancies.

NR-NST was associated with significantly increased incidence of decreased liquor, low Apgar score at 5 min of birth (>0.05), and perinatal mortality (>0.05) compared to R-NST in the HR group. Although the incidence of IPFD was not statistically significant between the reactive and NR subgroups in the HR group ($P > 0.05$), it appeared to be clinically significant.

In LR pregnancy group, there was one incidence of IPFD ($P > 0.05$), decreased liquor quantity in the NR subgroup when compared to the reactive subgroup.

NST can be effectively used in both the HR and LR pregnancies. This is because an R-NST result has a high NPV for mortality and morbidity, hence can reliably identify a healthy fetus. NST effectively identified the perinatal mortality case in the LR group and hence had high sensitivity in the LR group when compared to the HR group. On the other hand, an NR test has a high false-positive rate, hence does not reliably identify a compromised fetus in both the HR and LR groups. Hence, it has to be further evaluated by other tests like Doppler.

In conclusion, NST is a valuable screening test for detecting fetal compromise in both HR and LR fetuses. It should be clear that the NST can only be intended as a preliminary test rather than sole part of the comprehensive evaluation of HR patients. An R-NST indicates an uncompromised fetus, while an abnormal (NR) NST should alert the clinician to consider the possibility of fetal compromise and has to be followed up by other biophysical tests.

A total of 100 HR and 100 LR pregnant women were enrolled in a study conducted between October 2011 to September 2013 at MNR Hospital to evaluate the role of NST as a means of antepartum surveillance and in predicting perinatal outcome. All the pregnancies were followed up by NSTs from 32 weeks onward till the delivery, either done weekly or biweekly for a period of 20 min and for NR results, the test was extended up to 40 min. The NST done within 7 days of delivery was used for correlation with the perinatal outcome. The mode of delivery, perinatal morbidity, and mortality were studied in all the women. The two groups were well matched in age distribution, but primiparity was more common in the LR and HR groups. The incidence of NR-NST result was 24% in the HR group and 19% in the LR group. The LSCS rate was higher in the HR group (72%) when compared to the LR group (33%). Although the statistical incidence of IPFD was not that much significant between the reactive and NR subgroups of the HR group, it appeared clinically significant. Low Apgar score at 5 min of birth and perinatal mortality was significantly more in NR-NST result compared to reactive test result in the HR group.

On analysis of data collected, the sensitivity of NST in detecting perinatal mortality was as high as 100% in the LR group, whereas it was 75.0% in the HR group. The NST was also found to have a high NPV of 98.7% while the specificity was 78.1% in detecting morbidity and mortality. The false-positive rate of NST predicting fetal compromise was 21.9% for perinatal mortality in the HR

group. Therefore, NST is a valuable screening test for detecting fetal compromise in both HR and LR fetuses that may have a poor perinatal outcome. NST along with other parameters such as BPP and Doppler velocimetry will give a better information regarding the impending fetal risk.

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