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Original Research Article

The role of non-stress test as a method to evaluate the outcome of high-risk pregnancy: a tertiary care center experience

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ABSTRACT

Background: Non-stress test (NST) is a graphical recording of changes in fetal heart activity and uterine contraction along with fetal movement when uterus is quiescent. NST is primarily a test of fetal condition and it differs from contraction stress test which is a test of uteroplacental function. The present study aimed at evaluating the efficacy and diagnostic value of NST for antenatal surveillance in high-risk pregnancy and comparing the mode of delivery with test results.
Methods: A clinical study of NST was done between November 2014 to October 2015. NST was used for their surveillance from 32 weeks of gestation and NST was recorded weekly, biweekly, on alternate days or even on daily basis depending on high risk factors and were followed up.
Results: A total of 100 cases were enrolled in the study. The mean age of patients was 25.09±3.78 years. In all 14 cases (23.3%) with reactive NST underwent lower caesarean section (LSCS) whereas 36 cases (90%) with non-reactive NST underwent LSCS. The mean NST delivery interval with reactive NST was 9.8±7.1 hours and in cases with non-reactive NST it was 9.2±8.6 hours, the difference was statistically not significant (p=0.70).
Conclusions: NST tells about acute fetal hypoxia and decision to delivery time can be made for those patients with fetal distress so that a major improvement in the outcome among parturient can be achieved with abnormal NST results. An abnormal NST should alert the clinician of fetal compromise and has to be followed up by other biophysical tests.

Keywords: Non stress test, Acceleration, Bio physical profile, Fetal heart rate, Fetal movement, Contraction stress test

INTRODUCTION

Sequestered in the uterus, the developing fetus has until recently been the subject of much speculation and myth. Unable to see or examine an unborn child, obstetricians considered fetal wellbeing to be a by-product of maternal health. The fetus is no longer considered a transient maternal organ. The fetus is now a second patient who faces greater risks of serious morbidity and mortality. The ability to predict continued fetal survival for finite interval has a major implication for both mother and fetus. Advances in perinatal care in last 30 year have resulted in a dramatic decrease in perinatal mortality. These advances include improvement in fetal surveillance techniques and technologic aspects of neonatal intensive care. The association of specific intrapartum fetal heart rate (FHR) patterns with perinatal outcomes has led to the use of FHR monitoring for investigating antepartum problems.

The normal baseline record of FHR provides evidence that intrinsic control mechanisms responsible for cardiovascular autoregulation are intact. Control of FHR requires electrical conduction pathways, cellular receptors to circulating neurohormones, reflex arcs, and inherent myocardial contractility.[1] The use of specific FHR patterns to evaluate fetoplacental status is based on the association of their components with particular intrauterine events or conditions. These components include baseline rate, rate variation, and episodic rate responses to fetal movements (accelerations) or uterine contractions (decelerations).

Hammacher observed that the fetus can be regarded as safe, especially if reflex movements are accompanied by an obvious increase in the amplitude of oscillations and in the baseline fetal heart rate. This study formed the basis for the non-stress test (NST) and underscored the important association of FHR accelerations with fetal health. The NST was introduced to the USA nearly 10 years later through the work of Lee and associates and Rochard and co-workers who developed clinical testing schemes based on resting FHR tracings.[2]

As is discussed later, the value of reactivity or accelerations associated with fetal movement may vary considerably with the composition of the population tested, gestational age, the frequency of test repetition, and the use of other baseline FHR features in test evaluation, including the use of extended testing sessions and extension to earlier-gestational age categories. Contents are determined by both cellular and systemic mechanisms. Though there are many antepartum biophysical monitoring methods like contraction stress test (CST), NST, fetal biophysical profile (BPP), vibroacoustic fetal stimulation, amniotic fluid assessment, doppler velocimetry for high risk pregnancies, there is no single test ideal for all high-risk pregnancies.[3]

The NST is an effective approach for evaluating a wide range of potential antenatal problems, including intrauterine growth restriction (IUGR), prolonged gestation, preterm pregnancy, multiple gestation, Rh sensitization, and anomalies.[4] As a primary assessment tool, the NST has been suboptimal in the detection of IUGR, as many of these fetuses will continue to exhibit FHR reactivity in the face of abnormal fetal growth.[5] Risk assessment in prolonged pregnancy has been complicated by the relatively low frequency of truly postmature infants and the fact that highest perinatal risk occurs during the intrapartum period consequently, a falsely reassuring test may precede the occurrence of intrapartum fetal distress or meconium aspiration. Clinical studies of fetuses between 24 and 32-weeks' gestational age have found distinct maturational trends in FHR patterns, suggesting that interpretative criteria different from those used near term should be considered. Reactivity in preterm fetuses may be characterized by a higher incidence of low amplitude (10-15 beats/min) accelerations, weaker coupling between fetal movements and accelerations, and more frequent mild decelerations.[6,7]

Rh sensitization presents a relatively unique antenatal problem for FHR testing in that fetal problems include reduced oxygen carrying capacity, umbilical cord compression secondary to hepatomegaly, and intravascular volume disturbances. A feature of FHR testing peculiar to this condition is the so-called sinusoidal pattern, which is characterized by repetitive low-amplitude, uniform oscillations, usually without reactive accelerations. Fetuses exhibiting this pattern appear to be at extremely high risk for morbidity and mortality. Finally, reports of fetuses with a variety of congenital malformations have indicated that many will exhibit abnormal FHR patterns during antepartum testing.[8]

No specific pattern has been linked with any given anomaly, although non-reactivity in excess of 2 hours, with or without spontaneous decelerations, should prompt an ultrasonographic survey for malformations. NST is a graphical recording of changes in fetal heart activity and uterine contraction along with fetal movement when uterus is quiescent. NST is primarily a test of fetal condition and it differs from CST which is a test of uteroplacental function. It is one of most widely used primary testing method for assessment of fetal wellbeing and has also been incorporated into BPP system. It is not only simple and in expensive, it is also noninvasive and easily performed and interpreted. It consumes less time and has no contraindication for testing. More importantly, it can be used to screen a large population quickly in an OPD and can be performed by trained paramedical staff. The present study aims to evaluate the efficacy and diagnostic value of NST for antenatal surveillance in high-risk pregnancy. In this study we intend to evaluate the effectiveness and role of NST for assessing the perinatal outcome of fetuses in high risk pregnancies reporting to the outpatient department of obstetrics and gynaecology of Rohilkhand Medical College and Hospital, Bareilly.

METHODS

A clinical study of a NST as a test to assess the outcome of high-risk pregnancy was carried out in the Department of Obstetrics and Gynaecology, Rohilkhand Medical College and Hospital, Bareilly. Women with high risk pregnancies were randomly enrolled into the study and followed up with NST from 32 weeks of gestation and repeated at appropriate intervals. The study period was between November 2014 and October 2015. Detailed examination and history with investigation was done in each patient.

Inclusion criteria for selecting the study group were: patients of all age groups with informed consent. Singleton, non-anomalous pregnancies of 32 weeks or

more weeks of gestation. Only NST performed within 3-7 days prior to delivery were considered for the fetal outcome. Patients clinically suspected with or diagnosed cases of IUGR, preeclampsia, chronic hypertension, diabetes mellitus, previous fetal demise, decreased fetal movements, severe anemia, third trimester bleeding, post-dated pregnancy, Rh iso immunization, PROM, advanced maternal age (>35 years) were included in the study.

The exclusion criteria for the study group included: sedative usage in the mother 24 hours before testing. Malpresentations, patients with previous LSCS and cephalopelvic disproportion. Gestational age of <32 weeks. Major congenital anomaly of the fetus detected by routine antenatal ultrasound scanning.

The patients were divided into study group of high-risk pregnancies. NST was used for their surveillance from 32 weeks of gestation and NST was recorded weekly, biweekly, on alternate days or even on daily basis depending on high risk factors and were followed up. The patients were placed in left lateral position with pillow under the hips to displace the weight of the uterus away from IVC. The patients BP and pulse rate were recorded every 10 minutes during the procedure.

Non-stress test

This test was performed in patients, admitted to wards or labor room for a period of 20 minutes. If a reassuring test failed to occur within these 20 minutes, it was extended up to 40 minutes for non reactive traces. The NSTs were classified into 3 groups based on the presence or absence of at least 2 FHR accelerations of 15 bpm lasting for 15 seconds in a 20 minutes reading into reactive or normal test or reassuring test. Non-reactive or abnormal test or non-reassuring test. Suspicious or equivocal test - in these cases, NST was done with vibroacoustic stimulation and extended to 40 minutes and the results were further classified as reactive or normal and non-reactive or abnormal test based on the reactivity criteria.

Points considered in reading a graph

Baseline FHR, beat to beat variability, qualifying acceleration, and any decelerations if present.

Definition of a reassuring NST

Two or more accelerations that peak at 15 bpm or more, each lasting for 15 seconds or more, within 20 minutes of beginning the test.[9-12]

Definition of a non-reassuring NST

At the end of 40 minutes if there were no qualifying accelerations, baseline variability less than 5 bpm, late decelerations with spontaneous uterine contractions, and variable decelerations, repetitive and lasting for more than 30 seconds.[13-15]

The patients were followed up for the mode of delivery and the different variables of the perinatal outcome. At the time of delivery following data variables were collected like perinatal mortality, fetal distress during labour, 5 min APGAR score of >7, meconium stained amniotic fluid (MSAF), decreased liquor and the cord factor. Chi square test and student t test were used to assess variables and to determine if there was a significant difference between the means of two groups. SPSS version 16.0 was used for statistical analysis.

RESULTS

A total of 100 cases were enrolled in the study. Maximum pregnant women in our study were in the age group of 20-24 years (45%), and the least number of patients were 2% i.e., more than 35years of age (Table 1). The mean age of patients was 25.09±3.78 years. Primigravida were observed more frequently i.e., 56% (n=56) and multigravida were found in 44% (n=44) of pregnancy cases, in our study. The distribution of high-risk patients based on their clinical high-risk background is shown in (Table 2). Among the 100 patients with high risk factors 36 cases were of PET and eclampsia, 13 cases of severe anemia, 8 cases of decreased FM, 6 cases each of gestational diabetes mellitus and prolonged pregnancy, 11 cases of premature rupture of membrane (PROM), 2 cases of previous IUD/still birth and 2 cases of advanced maternal age (Figure 1).

Table 1: Age wise distribution of high-risk pregnancy.

Age (years)	Number of cases (%)
20-24	45 (45)
25-29	41 (41)
30-34	12 (12)
≥35	2 (2)
Total	100 (100)

Table 2: Distribution of high-risk pregnancy cases according to clinical high-risk factors.

Risk factors	Number of cases (N)	Percentage (%)
PET and eclampsia	39	39
Severe anemia	16	16
Decreased FM	12	12
Gestational DM	10	10
Prolonged pregnancy	6	6
PROM	11	11
Previous IUD/Still birth	4	4
Advanced maternal age	2	2

The patients in high risk groups were classified based on the NST result into normal/reactive and abnormal or non-reactive test result categories. The incidence of abnormal result was 40% in our study (Figure 2).

The mean gestational age in high risk cases with reactive NST and non-reactive NST result were 38.5±2.1 weeks and 37.9±2.6 weeks respectively (Table 3). The difference in mean gestational age between these two NST- results was not statistically significant. The patients in the present study were followed up for mode of delivery. There were 50 patients (50%) who underwent LSCS and 50 patients (50%) delivered vaginally. In 22 pregnant women the labor was augmented with oxytocin while in 78 others augmentation was not needed.

In the present study 14 cases (23.3%) with reactive NST underwent LSCS whereas 36 cases (90%) with non-reactive NST underwent LSCS (Figure 3). Rest had a vaginal delivery. In our study 12 cases (30%) with non-reactive NST developed intrapartum fetal distress (IPFD) compared to 4 cases (6.6%) with reactive NST who had IPFD for which they underwent LSCS (Figure 4).

Table 3: Descriptive statistics of mean gestational age in high risk based on NST result.

NST result	No. of subjects	Period of gestation in weeks (mean)	SD	t value	P value
NR	40	37.9	2.6		
R	60	38.5	2.1	1.271	0.2066

NR - Non reactive, R - Reactive.

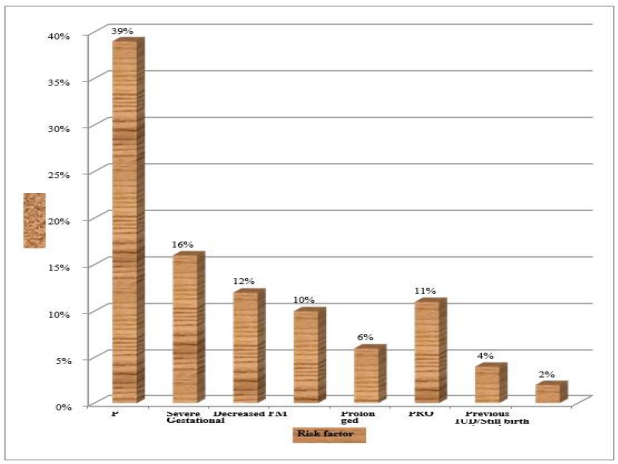

Figure 1: Distribution of high-risk pregnancy cases according to clinical high-risk factors.

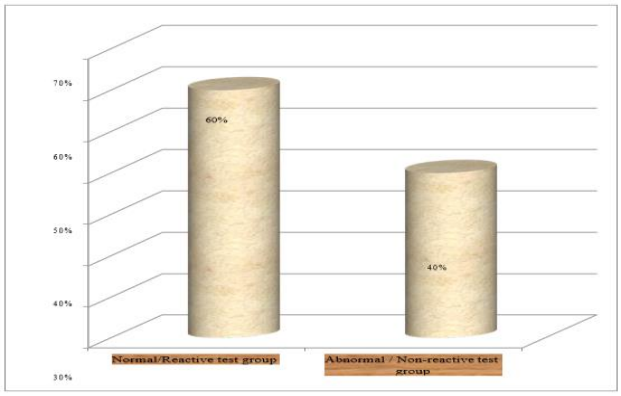

Figure 2: Distribution of patients based on NST results.

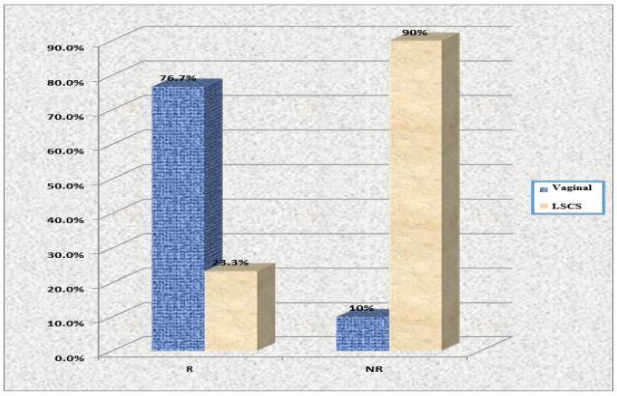

Figure 3: Distribution of cases in high risk groups based on mode of delivery and NST results.

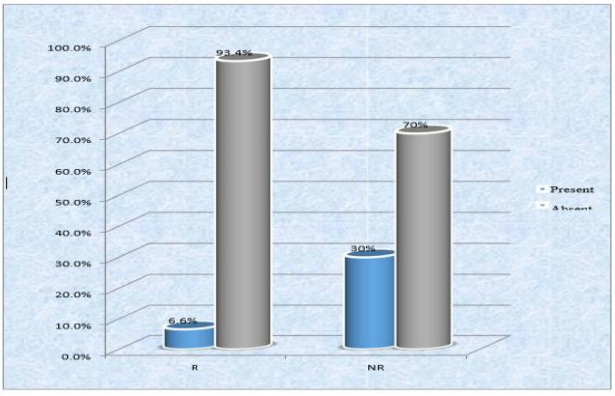

Figure 4: Distribution of cases who underwent caesarean section for IPFD.

DISCUSSION

NST is one of the easiest tests to perform and cost effective. There are considerable number of clinical studies that support the use of NST in the management of high-risk pregnancies. From all the above-mentioned studies, it is concluded that most of the antenatal mothers belong to almost same age group i.e., between 25-30 years. In the present study, it was found that the mean age

was 25.09±3.78 years, which was almost comparable to the age groups in other studies.[16-22,29]

In the present study total number of cases with reactive NST was 60% and with non-reactive NST was 40%. This result is consistent with the study done by Himabindu et al which showed 70% reactive and 30% non-reactive NST, Panchal et al which showed 55% reactive and 45% non-reactive NST. Also, the study done by Mehta et al showed similar results.[23-28,30]

High-risk pregnancy case in most of the studies were PET and Eclampsia shown as in the study by Mehta et al where it was 60%, in the study by Panchal it was 60%, in the study by Himabindu it was 43% which is almost comparable to the present study in which it was 39%.[27,30] The study done by Begum et al however has only 10% of cases of PET.[29]

Mode of delivery in the study by Edessy et al included 61% vaginal and 39% LSCS, study by Raouf et al had 57.3% vaginal whereas 42.7% LSCS, study by Himabindu included 54% vaginal delivery and 46% of the patient had undergone LSCS and in the present study 50% of the patient had vaginal delivery and 50% underwent LSCS which is comparable to the above mentioned studies.[28,32]

In the present study 76.7% of antenatal women delivered vaginally with reactive NST and 23.3% of antenatal women delivered with caesarean section with reactive NST which was almost comparable to Himabindu et al (2015) and Deshpande et al study.[30,31]

In present study 10% of antenatal women delivered vaginally with non-reactive NST and 90% of women of antenatal women delivered with caesarean section with non-reactive NST which was almost comparable to Himabindu et al and Deshpande et al study.[31]

In the study by Himabindu the APGAR score at 5 minutes included 17 cases with APGAR score <7 and 83 cases with APGAR score >7.[30] In the study by Ocak APGAR score was <7 in 62 cases and >7 in 2099 cases and in the present study APGAR score of <7 included 27 neonates and of >7 included 73% which is not comparable to the above-mentioned studies.[13,34-36]

CONCLUSION

The antenatal surveillance of high-risk pregnancies with NST can effectively screen for identification of high-risk fetuses and segregate the population that is at risk for perinatal mortality and morbidity. The potential advantage of NST is that, it is cost effective, easy to use, comfortable to mother and tell about acute fetal hypoxia hence 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 parturient can be achieved with abnormal (non-reactive) NST results.

The use of NST in monitoring high risk pregnancies may result in an increase in the incidence of operative delivery as seen in our study (50% LSCS). NST can be effectively used in high risk pregnancies because a reactive NST result has a high negative predictive value for mortality and morbidity hence, can reliably identify a healthy fetus. On the other hand, a non- reactive test has a high false positive rate, hence does not reliably identify a compromised fetus in high risk pregnancies. Hence an abnormal (non- reactive) NST should alert the clinician to consider the possibility of fetal compromise and has to be followed up by other biophysical tests. In conclusion, NST is a valuable screening test for detecting fetal compromise in pregnancies that have a poor perinatal outcome.

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