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Non- Stress Test: A Tests to Assess the Outcome of High-Risk Pregnancy

Medha[1], Datta S.K.,[2] Lee C.S.

[1]Department of Obstetrics and Gynaecology, B.R. Singh Hospital & Centre for Medical Education & Research, Sealdah, Kolkata ,

[2]Department of Obstetrics and Gynaecology, B.R. Singh Hospital & Centre for Medical Education & Research, Sealdah, Kolkata

Corresponding author: Dr. Medha

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KEYWORDS

Non-stress test, Fetal heart rate, Fetal movement

ABSTRACT:

Background:

The non-stress test (NST) is a widely used technique for antepartum fetal evaluation. It detects fetal heart rate acceleration in response to fetal movement, reflecting the association between fetal neurological status and cardiovascular reflex responses. This association is one of the earliest indicators to disappear during progressive fetal compromise.

Methods:

This study evaluated the predictive value of NST for fetal outcomes in high-risk pregnancies. One hundred women with high-risk pregnancies were enrolled between August 2013 and May 2016 at the Department of Obstetrics and Gynecology, B.R.S.H., Kolkata. NST was performed using cardiotocography (CTG) according to NICE guidelines.

Results:

Of the 100 patients, 22% had non-reactive NST results, while 78% had reactive results. The risk of intrapartum fetal distress (IPFD) was 8.31 times higher for patients with non-reactive NST results compared to those with reactive results ($p < 0.05$). NICU admission rates were higher in the non-reactive group (9.1%) than in the reactive group (3.8%). Perinatal mortality rates were also higher in the non-reactive group (4.5%) than in the reactive group (1.3%).

Conclusion:

While preventing stillbirths is crucial, ensuring the birth of a healthy baby without birth-related disabilities or complications is equally important. Research aimed at developing tests to detect and prevent neurodevelopmental defects is desirable. Currently, NST primarily focuses on preventing stillbirths.

Introduction:

Antepartum assessment of fetal well-being has become an essential component of prenatal care for all pregnancies. The primary goal of modern obstetrics is to ensure a healthy mother and a healthy child. To achieve this, various biochemical and biophysical methods have been recommended. The main objective of antepartum surveillance is to detect fetal distress, prevent fetal death, and avoid unnecessary interventions (ACOG)[1].The Non-Stress Test (NST) is a simple, inexpensive, non-invasive, and widely used test that evaluates fetal well-being. It assesses the relationship between fetal heart rate (FHR) and fetal movement (FM), recorded using ultrasound

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devices with Doppler technology. The NST should be offered to all high-risk pregnant women.Maternal risk factors for antepartum surveillance include: Pre-eclampsia, Diabetes, Antepartum hemorrhage (APH), Post-caesarean pregnancy,Post-term pregnancy, Other medical conditions (e.g., Systemic Lupus Erythematosus, SLE) .Fetal risk factors include: Preterm labor, Intrauterine growth restriction (IUGR), Multiple pregnancy,Oligohydramnios, Meconium-stained liquor,Intrauterine infection, Abnormal Doppler findings.Additional risk factors arising during labor include:Augmented labor, Epidural anesthesia-,Meconium-stained liquor.According to Boehm et al.[2], high-risk patients should undergo twice-weekly NST evaluations when used as the primary test for fetal stress assessment

Methods and Materials:

This cross-sectional, prospective observational study was conducted at B.R. Singh Railway Hospital from November 2013 to May 2015.

Inclusion Criteria:

- High-risk pregnant women with singleton, non-anomalous pregnancies

- Gestational age ≥ 32 weeks

- Attending antenatal OPD or admitted in indoors (both emergency and registered patients)

- Both labor and non-labor patients

Exclusion Criteria:

Gestational age less than 32 weeks,

Malpresentation

Patient with cephalopelvic- disproportion,

Congenital anomaly of the fetus detected on routine ultrasound scanning,

Intrauterine fetal death,

Antepartum haemorrhage were excluded from study**.**

Study Design:

Hundred high-risk pregnant women were enrolled. Patients were followed up from admission to delivery .frequency of Non-Stress Test (NST) was determined by high-risk factors:- Weekly, Biweekly Alternate days, Daily

NST Procedure:

Cardiotocograph with 2 MHz transducer, Initial duration: 20 minutes, Extended up to 40 minutes if non-reassuring. Interpretation: Non-reactive: Positive test, Reactive: Negative test

Follow-up:

Reactive test: Rescheduled for repeat test in 1 week

- Non-reactive test: Repeated within 24 hours

- Persistent non-reactive pattern: Considered for delivery

Statistical analysis: It was performed with help of Epi info (TM) 3.5 .3. x^2 test was used to test the association of different variables with the study groups. Z- test was used to test the significant difference between two proportions. T- test was used to compare the means. Odds ratio (OR) with 95% confidence interval (CI) was calculated to measure the different risk factors. Diagnostic accuracy, Sensitivity, Specificity, Positive Predictive value of test were also calculated. p value of <0.05 was considered Statistically significant.

Results:

A total of 100 females with high-risk pregnancy were included in the study. Table 1 shows distribution of high-risk pregnancy according to clinical high-risk factors. Most of the patients were with pre-eclampsia (23%) followed by severe anemia (21%), IUGR (17%) and decreased FM (10%). only 1% had RH isoimmunization.

Table 1: Distribution of high-risk pregnancy cases according to clinical high-risk factor

Pre-eclampsia-	23	23.0%
Severe anemia	21	21.0%

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IUGR	17	17.0%
Decreased FM	10	10.0%
GDM	8	8.0%
PROM	5	5.0%
Advanced maternal age	5	5.0%
BOH	5	5.0%
Prolonged pregnancy	5	5.0%
Rh isoimmunization	1	1.0%
Total	100	100.0%

Out of 100 patients as per NST result 22% were found non-reactive and 78% were found reactive

Table 2: Distribution of NST results

NST result	**number**	**%**
Non-reactive	22	22.0%
Reactive	78	78.0%
Total	100	100.0%

Pregnant women in our study were in the age group of 18-39 years. The mean age of NR group was 25.72±6.11 years and R group was 26.66±5.87 years. Proportion of primigravida was higher in NR group (36.4%) as compared to R group (23.1%) in our study. The mean gestational age in cases with reactive NST and non-reactive NST result were 37.98±0.56 weeks and 38.15±1.19 weeks respectively

Table 3: Demographic profile

Age Group	**Non-reactive (22)**	**Reactive (78)**	**Total (100)**
<20	4 (18.2%)	11(14.1%)	15
21-29	12(54.5%)	36(46.2%)	48
30-39	6	31(39.7%)	37
Gravida			
Primi	8(36.4%)	18(23.1%)	26
Multi	14(63.6%)	60(76.9%)	74
Gestational age			
37.0-40.0	19(86.4%)	77(98.7%)	96
>40.0	3(13.6%)	1(1.3%)	4

The patients were followed up for mode of delivery. There were 39 patients (39%) who underwent LSCS and 61 patients (61%) delivered vaginally. In this study 22 cases (28.2%) with reactive NST underwent LSCS whereas 17 cases (77.3%) with nonreactive NST underwent LSCS. 9 cases (40.9%) with nonreactive NST and 13 cases (59.1%) with reactive NST developed intrapartum fetal distress (IPFD), for which they underwent LSCS. The risk of intrapartum fetal distress (IPFD) was 8.31times more for patients with non-reactive NST result as compared to the patients with reactive NST result and the risk was significant. Proportion of NICU admission was higher in non-reactive group (9.1%) as compared to reactive group (3.8%). proportion of perinatal deaths was higher in NR group (4.5%) as compared to R group (1.3%).

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Table 4: Mode of delivery

Mode of delivery			
L.S.C. S	17(77.3%)	22(28.2%)	39
NVD	5 (22.7%)	56(71.8%)	61
Intrapartum fetal distress			
Present	9 (40.9%)	6(7.7%)	15
Absent	13 (59.1%)	72(92.3%)	85
NICU admission	2(9.1%)	3(3.8%)	5

There was no significant association between perinatal outcome and groups (p=0.91). proportion of perinatal deaths was higher in NR group (4.5%)as compared to R group(1.3%).The risk of death was 3.66 times more for patients with non-reactive NST result as compared to the patients with reactive NST result [OR=3.66(0.22,61.11); p=0.91) and the risk was not significant.

Table 5: Perinatal outcome

Died	1(4.5%)	1(1.3%)	2
Good	21(95.5%)	77(98.7%)	98

Discussion

This study aimed to evaluate the predictive value of Non-Stress Test (NST) for pregnancy outcomes and early neonatal outcomes. Our findings showed no significant difference in maternal age and gravidity between reactive and non-reactive NST groups, consistent with previous studies (Dellinger et al).Notably, our study revealed that the risk of non-reactive test results was 12.15 times higher for patients with gestational age > 40 weeks compared to those with gestational age < 40 weeks. This finding contrasts with Tong Li et al[3] case-control study, which suggested that NST may not be effective in preventing fetal death in post-term pregnancies.Our results indicate that patients with non-reactive NST had a significantly higher risk of Lower Segment Caesarean Section (LSCS) (77.3% vs. 28.2%, p < 0.05) and an 8.65 times increased risk of LSCS. This is consistent with Phelan et al[4] findings, which showed increased caesarean section rates and perinatal mortality in non-reactive groups However, our study also found that normal NST results did not guarantee favorable outcomes, with 28.2% of reactive patients undergoing caesarean section due to obstetric indications. This highlights the limitations of NST in predicting outcomes.Regarding NICU admission, our study showed no significant association between NST results and NICU admission (p = 0.91%). The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of NST for perinatal outcome were 50.0%, 78.5%, 4.5%, and 96.1%, respectively. These findings are comparable to those reported by Ocak et al[5].The low sensitivity and PPV of NST suggest its limitations in predicting perinatal outcomes. Sharbaf et al. and Salamalekis et al[5-6]. reported similar findings, highlighting the importance of combining NST with other diagnostic tools..

Conclusion:

Despite its recommendation, simplicity, and affordability, Non-Stress Test (NST) has limitations as an efficient tool for monitoring fetal outcomes. Its low sensitivity and positive predictive value rates hinder its reliability as a standalone modality for decision-making. Alternative fetal monitoring tests, such as:Doppler study,Continuous fetal electrocardiogram recording,Fetal pulse oximetry,Fetal scalp sampling with blood gas or lactate analysis should be considered for more accurate assessments.However, in resource-

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constrained settings, like developing countries (e.g., India), NST remains a valuable, non-invasive screening tool for detecting fetal distress and timely referral of high-risk patients to specialized centers.Recent studies highlight concerns regarding routine Electronic Fetal Monitoring (EFM), which may increase caesarean section and operative vaginal delivery risks.Further studies are necessary to: Establish validity and reliability standards for NST, Evaluate the efficacy of combining NST with other diagnostic modalities, Develop more accurate and efficient fetal monitoring tools.By addressing these knowledge gaps, healthcare providers can optimize fetal monitoring strategies, improving maternal and neonatal outcomes.

Ethical approval: The study was approved by the Institutional Ethics Committee

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