



Original Research Article

Role of non stress test in monitoring antenatal fetal well being in high risk pregnancy

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ABSTRACT

Background: Antepartum evaluation of the fetus at risk for damage or death in utero remains a major challenge in modern obstetrics. Freeman & Lee (1975)¹ and colleagues introduced the non-stress test to describe acceleration of fetal heart rate is a sign of fetal health in response to fetal movement.

Aims: Role of Non stress test in antepartum fetal surveillance and perinatal outcome in high risk pregnancy. To prove the efficacy of NST as an effective tool for evaluation of fetal well-being. To decrease perinatal morbidity and mortality.

Materials and Methods: Hospital based prospective study. 50 pregnant women with high risk factors as study group and 50 healthy pregnant women as control group were randomly selected from period of July 2015 to December 2015 in the department of Obst & Gynae Dr. S. N. Medical college Jodhpur. Non stress test performed and results were analysed.

Results: Non stress test as screening test for antenatal fetal surveillance has high specificity and high negative predictive value.

Conclusion: The ideal test for fetal reserve should be safe, inexpensive, readily available, quickly exerted and devoid of either false positive or false negative results. As yet no such test exists which is perfect, still NST has been shown to be most acceptable modality for evaluating the fetus in utero.

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1. Introduction

A high risk pregnancy is one in which some conditions put the mother, the developing fetus, or both at higher than normal risk for complications during or after the pregnancy and birth. Antepartum evaluation of the fetus at risk for damage or death in utero remains a major challenge in modern obstetrics.

According to American College of Obstetrician and Gynaecologists and American Academy of Pediatrics (2012)² the objectives of antepartum fetal surveillance are to prevent fetal death and avoidance of unnecessary intervention.¹

The test is named “non-stress” because no stress is placed on the fetus during test. Among all available tests this is simple to be done, can be repeated, non-harmful, cost

effective, handy and low maintenance. It is most widely used primary testing method for assessment of fetal well-being.

1.1. Basic pattern recognition and interpretation

1. Characteristic of normal heart rate pattern.
2. Baseline heart rate-110-160bpm.
3. Baseline variability > 5bpm.
4. No of acceleration > 2 in 20 min period.
5. No of deceleration-absent or early deceleration.
6. Fetal outcome: vigorous with Apgar score > 7.

1.1.1. Interpretation

1. Reassuring: Two or more FHR acceleration of 15 bpm for 15 seconds in 20 min usually associated with episodes of fetal movement and normal baseline variability more than 5 bpm.

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Table 1: Fetal heart rate feature categorization (RCOG, NICE)

Features	Baseline FHR	Variability	Deceleration	Acceleration
Reassuring	110-160 bpm	>5 bpm	None	Present
Non reassuring	100-109 bpm 161-180 bpm	<5 bpm for >40 min but <90 min	Early deceleration Typical Variable deceleration Single prolonged deceleration ≤ 3 min	Absence of acceleration with an otherwise normal CTG is of uncertain significance
Abnormal	<110 >180bpm sinusoidal pattern for ≥10 min	<5 bpm for >90 min	Atypical variable deceleration Late deceleration Single prolonged deceleration > 3 min	

2. Non-reassuring: any tracing with no FHR acceleration or inadequate acceleration that is less than 15 bpm or a tracing with decreased FHR variability.
3. Sinusoidal: super imposed or non-reassuring pattern. It is smooth undulating FHR pattern with a frequency of 2-5 cycles/min. Long Term variability and amplitude of 5-15 beats/min with the absence of acceleration or fixed or flat short term variability. Oscillation of sinusoidal waves from above or below the baseline.
4. Unsatisfactory: tracing not adequate for interpretation.
5. Salutatory: rapidly recurring couplets of acceleration and deceleration causing relatively large oscillation of baseline FHR.

2. Materials and Methods

The present prospective study was conducted in department of Obstetrics & Gynaecology, Umaid hospital, Jodhpur from period of July 2015 to December 2015. The study was done on 100 cases. 50 high risk pregnancies were taken randomly as study group and 50 normal pregnancy cases were taken randomly as control group. The subjects were explained the test, need of the test, done after 28 weeks of gestation.

2.1. Inclusion criteria

Pregnancy complicated by

Hypertensive disorders -Pre-eclampsia and chronic hypertension, Diabetes complicating pregnancy, including gestational diabetes (GDM), Intra-uterine growth retardation (IUGR), Post dated pregnancy, Liquor abnormalities, Recurrent pregnancy losses (RPL), Pregnancy with previous cesarean section, Multiple gestation, Pregnancy with medical illness, Loss or decreased fetal movements, Rh isoimmunization and Anemia.

2.1.1. Exclusion criteria

Pregnancy with gestational age <28 weeks, Antepartum hemorrhage, Eclampsia, Congenital anomalies, Intrauterine fetal death (IUFD).

2.2. Method

Testing protocol for NST

1. Equipment: electronic fetal-maternal monitor.
2. FHR: Doppler signal source (Piezo-electric effect).
3. Uterine contraction: External tocodynamometer + manual palpation.
4. Fetal Movement: Remote event marker + observer confirmation.
5. Maternal position: semi-Fowler's, lateral hip displacement.
6. Baseline observation period: 20 min.
7. Maternal fed state: 2 hr postprandial.
8. Maternal activity: 2 hr sedentary.
9. No smoking; sedative drug within 2 hr.

3. Observations and Results

Study (high risk) and Control (healthy) group each had 50 cases.

Table 2: Types of cases in study group (High risk cases)

Study group	No. of patients	Percentages
Hypertensive disorders	17	34%
Oligohydramnios	14	28%
IUGR	9	18%
Decreased or Loss of fetal movements	6	12%
Fetal hypoxia	6	12%
GDM	4	8%
Heart disease	4	8%
Previous cesarean	4	8%
Multiple gestation	2	4%
Recurrent pregnancy losses	2	4%
Rh Isoimmunization	2	4%
Precious pregnancy	2	4%
Hemoglobinopathy	1	2%
Postdatism	1	2%
Jaundice	1	2%

Hypertensive disorders, oligohydramnios and IUGR are commonest risk factors.

Table 3: Various combinations of diagnosis included in study group

Types of cases	No. of patients	Percentages
PIH	5	10%
GDM	4	8%
Oligohydramnios with IUGR	4	8%
Oligohydramnios	3	6%
Decreased fetal movements	3	6%
PIH with oligohydramnios	3	6%
Fetal hypoxia	3	6%
Heart disease	3	6%
Severe pre eclampsia	2	4%
Multiple gestation with PIH	2	4%
Previous cesarean with UPI	2	4%
Precious pregnancy with oligohydramnios with IUGR	1	2%
Postdatism with PIH	1	2%
Recurrent pregnancy losses	1	2%
PIH with RPL	1	2%
Previous cesarean with decreased fetal movement	1	2%
Previous cesarean, IUGR, oligohydramnios	1	2%
Oligohydramnios with decreased fetal movement	1	2%
Heart disease with IUGR	1	2%
Fetal hypoxia with IUGR	1	2%
Rh isoimmunization with IUGR with eclampsia	1	2%
PIH with IUGR	1	2%
Hemoglobinopathy	1	2%
Rh isoimmunization with pre eclampsia	1	2%
Jaundice	1	2%
Loss of fetal movement	1	2%
Precious pregnancy with oligo	1	2%

PIH, GDM and oligohydramnios with IUGR are commonest.

Table 4: Distribution of cases according to maternal age

Age (Years)	Control group	Study group	Non-reassuring NST (Study group)
18-22	14 (28%)	16 (32%)	2 (12.5%)
23-26	23 (46%)	21 (42%)	5 (23.8%)
27-30	12 (24%)	11 (22%)	2 (18.18%)
31-34	1 (2%)	2 (4%)	0 (0%)

Most of the patients belong to 23-26 years age group as this is peak reproductive age group.

Majority of patients are primi gravid.

Table 5: Distribution of cases according to gravida

Gravida	Control group	Study group
Primigravida	26 (52%)	30 (60%)
Multigravida	20 (40%)	16 (32%)
Grand multigravida	4 (8%)	4 (8%)

In study group, 3 patients had reassuring NST with abnormal perinatal outcome and diagnosis was severe pre eclampsia, previous cesarean with decreased fetal movement and previous cesarean with severe oligo with severe IUGR.

Perinatal mortality and morbidity not shown in any of the patient in control group.

In study group 82% had Reassuring NST out of which 4.87% had perinatal morbidity while 2.44% had perinatal mortality. In study group 18% had non-reassuring NST out of which 22.2% had perinatal morbidity while 11.1% had perinatal mortality.

9 patients in study group had ominous NST pattern and 5 (55.5%) out of 9 had fetal hypoxia, 2 (22.2%) had decreased fetal movements, 1 (11.1%) had loss of fetal movement and uteroplacental insufficiency.

3 (33.3%) had gestational age less than 37 weeks while 6 (66.6%) had gestational age more than 37 weeks.

4 (44.4%) out of 9 delivered vaginally while 5 (55.5%) undergone LSCS.

2 (22.2%) had neonatal morbidity while 1 (11.1%) had neonatal mortality.

In control group 7 new born had Apgar score of 10, 39 had score of 9 and 4 had score of 8. None in control group had low (<7) Apgar score. While in study group 3 new born had score of 10, 32 had score of 9, 9 had score of 8 and 6 had low apgar score.

4. Discussion

During the past decades remarkably intimate knowledge of human fetus along with technological developments have prompted a new phenomenon in medicine of forecasting fetal health.

In present study focus is on contemporary testing procedures that depend on fetal heart rate.

In this decade characteristics of fetal heart rate testing has been used increasingly to predict the condition of fetus during antenatal period.

5. Summary

The present study highlighted the following points:

1. 21 (42%) patients in study group were of 23-26 years age group i.e. period of maximum reproductive capacity.

Table 6: Reassuring NST with abnormal perinatal outcome in study group

S. No.	Obstetric complication	Gestational age	NST Impression	Birth asphyxia	Mode of delivery	Duration of nursery stay
1	Severe pre eclampsia	32 Wks	Reassuring	Present	Vaginal delivery	19 days (LBW 1.47kg)
2	Previous LSCS with decreased fetal movements	>37 Wks	Reassuring	Present	Elective LSCS	2 days Then mother shifted
3	Prev LSCS with s. oligo withs. IUGR	28 Wks	Reassuring	Present	LSCS (Scar dehiscence)	29 days (LBW 1.1kg Baby expired)

Table 7: Relationship between NST and Perinatal morbidity & mortality

Cases	Total	Perinatal morbidity	Perinatal mortality
Reassuring NST			
Control	50 (100%)	0	0
Study	41 (82%)	2 (4.87%)	1 (2.44%)
Non-Reassuring NST			
Control	0	0	0
Study	9 (18%)	2 (22.2%)	1 (11.1%)

Table 8: Ominous NST pattern in study group

S. No.	Obstetric complication	Gestational age	NST Impression	Mode of delivery	Indication of LSCS	Duration in Nursery Stay
1	Fetal hypoxia	>37 wks	Late deceleration	FTND	-	2 Days
2	Prev. LSCS with UPI (fetal hypoxia)	32 wks	Late deceleration	LSCS	Prev. LSCS with UPI	Expired on 14 th day in nursery (severe birth asphyxia)
3	Fetal hypoxia	>37 wks	Late deceleration	FTND	-	-
4	Fetal hypoxia with IUGR	36 wks	Late deceleration	FTND	-	-
5	Decreased fetal movements with 2LOC	>37 wks	Loss of variability	LSCS	Decreased fetal movements with 2LOC	-
6	Decreased fetal movement	36 wks	Loss of variability	FTND	-	-
7	Fetal hypoxia	>37 wks	Prolonged deceleration	LSCS	Fetal hypoxia	3 Days
8	Prev. LSCS with fetal hypoxia	>37 wks	Late deceleration	LSCS	Prev. LSCS with fetal hypoxia	-
9	Loss of fetal movement	>37 wks	Loss of variability	LSCS	Loss of fetal movement	-

Table 9: Low 5 minute Apgar score in control & study group

Apgar Score	Control group	Study group
10	7	3
9	39	32
8	4	9
7	-	-
<7	-	6

Table 10: Low 5 Minute Apgar score & NST interpretations in study group

NST interpretation	Abnormal	Normal	Number
Non-reassuring	3	6	9
Reassuring	3	38	41
Total	6	44	50
Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
50%	86.3%	33.3%	92.68%

Table 11: Indications by various authors

Authors	Hypertensive disorders	IUGR	Decreased fetal movements	GDM	Post-datism	Previous LSCS	Rh incompatibility
Lee Drukker et al (1979)	27.3%	-	1.9%	10.1%	40.3%	-	1.6%
Manning et al (1980)	9.2%	7.8%	-	34%	40.2%	-	2.7%
Rayburn et al (1980)	6%	4.8%	-	6%	9.7%	-	-
Manning et al (1981)	17.5%	20.8%	4.3%	9.2%	11.6%	4.9%	1.1%
Dastur et al (1981)	22%	-	-	1.6%	10.1%	-	-
Phelan et al (1981)	13.1%	20.7%	7%	8.4%	35.8%	-	0.4%
Chamberlain (1984)	20.5%	18.4%	-	-	15%	-	-
Hafizur Rahman et al (2012)	20.6%	11.3%	-	3.1%	42%	-	4%
Dr P. Himabindu et al (2015)	43%	11%	-	7%	39%	-	5%
Present study (2015)	34%	18%	14%	8%	2%	8%	4%

The findings of present study are similar to study done by Chamberlain (1984) and Dr. P. Himabindu et al. (2015).

Table 12: Age distribution

Present study (2015)		Dr. P. Himabindu et al (2015)		Hafizur Rahman et al (2012)	
Age(years)	No. of patients	Age(years)	No. of patients	Age	No. of patients
18-22	30%	18-20	23%	17-20	13.12%
23-26	44%	21-25	50%	21-25	42.5%
27-30	23%	26-30	23%	26-30	31.25%
31-34	3%	31-35	4%	31-40	13.13%

The majority of cases in current study belong to 23-26 years age group that is similar to recent study done by Dr. P. Himabindu et al. (2015) as this is peak reproductive age.

Table 13: Gravida wise distribution

Gravida	Saadia Z (2015)	Hafizur Rahman et al (2012)	Present study (2015)	Dr. P. Himabindu et al (2015)
Primi gravida	62%	61.87%	56%	55%
Multi gravida	37.9%	38.13%	36%	41%
Grand multi gravida	-	-	8%	4%

According to gravid wise distribution present study is similar to study done by Dr. P. Himabindu et al. (2015).

Table 14: Low 5 minutes Apgar score in different studies

Authors	No. of Patients	Low 5 minute Apgar score
Rochard (1976)	125	-
Kubli (low risk)1977	1320	-
Visser (1977)	434	3
Flynn (1977)	301	13
Nochimson (1978)	421	-
Kubli (high risk) 1977	65	32
Abhijit Biswas et al (2013)	100	11
Dr P. Himabindu et al (2015)	100	17
Present study (2015)	100	6

Low 5 minute Apgar score in different studies and present study is close to study done by Abhijit Biswas et al. (2013).

Table 15: Comparisons of value of test in different studies

Authors	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Neldam et al (1986)	-	80%	50%	-
Bhide AA et al (1990)	65.64%	-	23.12%	-
Hafizur Rahman et al (2012)	60%	94.8%	56.8%	88.6%
Abhijit Biswas et al (2013)	72.7%	72.7%	30.7%	94.1%
Dr. P. Himabindu et al (2015)	82.3%	80.7%	46.6%	95.7%
Present study (2015)	50%	86.3%	33.3%	92.68%

- 30 (60%) patients in high risk group were primigravida and most common (34%) high risk factor was hypertensive disorder in pregnancy followed by oligohydramnios (28%).
- Non-reassuring NST was common (23.8% among 23-26 years age group and primigravida patients (23.3%).
- Cesarean deliveries were common (18% among high risk group than control group (0%).
- Perinatal morbidity and mortality was common (12%) among high risk group compared to study group (0%).
- The sensitivity for perinatal morbidity and mortality was 50% i.e. NST detected 50% of all abnormal outcome.
- The non-reassuring NST may be due to sleeping state, sedative drugs to mother, prematurity, chronic hypoxia or major congenital anomalies so before getting NST to be non-reassuring one should extend the duration of NST for another 20 min and should not hurry to intervene pregnancy rather should keep in mind the possible causes of non reactivity and manage accordingly.
- Non stress test is easy to perform, informative, non invasive, reproducible, inexpensive, having no contraindication (if doubt can be repeated) but require proper logical interpretation for reliable prediction of outcome.
- Antepartum fetal surveillance gave more reassurance to the obstetrician and decreased the number of hospital admission as well as the duration of hospital stays of many mothers.
- None of new born in control group had low (<7) Apgar score while it was seen in 6 new born babies in study group. So fetal compromise is common in high risk pregnancy.

6. Conclusion

The ideal test for fetal reserve should be safe, inexpensive, readily available, quickly exerted and devoid of either false

positive or false negative results. As yet no such test exists which is perfect, still NST has been shown to be most acceptable modality for evaluating the fetus in utero.

Until a perfect method is devised, the importance of judicious use and meticulous interpretation of NST (CTG) will continue to dominate the science of fetal surveillance. The charm of NST is

1. Greater specificity
2. Total non-invasiveness

Golden days of NST (CTG) are round the corner.

7. Source of Funding

None.

8. Conflict of Interest

None.

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