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Research Article

Correlation of non stress test with fetal outcome in term pregnancy (37-42 Weeks)

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ABSTRACT

Background: The main purpose of the various antepartum surveillance techniques is to detect fetal distress so as to prevent fetal death. Traditionally, obstetricians tended to classify pregnant women as “low” and “high” risk. Although many well-organized methods are available for managing the high-risk group, we need more efficient methods for identifying pregnant women in distress in the low-risk group. The idea of taking this study using NST as a tool for routine antepartum fetal surveillance is we will be trying to catch up those fetuses who might be at risk in womb and provide prompt intervention in otherwise considered normal pregnancies without any obvious high risk factor thus giving the best outcome in mothers. The objective of this study was to evaluate the correlation of the Non Stress Test with fetal outcome in pregnancies from 37-42 weeks of gestation.

Methods: This was a prospective longitudinal study at Acharya Vinoba Bhave Rural Hospital Sawangi (Meghe) Wardha and Dept. of Obstetrics and Gynaecology Unit from August 2011- July 2013. This study included 100 normal pregnant mothers from 37 weeks to 42 weeks who were subjected to NST for 20 minutes.

Results: The incidence of reactive test was 85% and that of Non reactive NST was 15% .As the gestational age advances the incidence of NR NST is more. Postdatism (gestation >40 weeks) is found to be an important factor for NR NST. Mode of delivery was related to results of Non stress Test in terms of maximum vaginal delivery in Reactive groups, Operative deliveries which occurred in the Reactive groups were also due to indications other than fetal distress. Caesarean section rate is slightly higher in non reactive NST. The individual parameters of poor fetal outcome like meconium stained liquor, Apgar score <7 at 5 minutes had increased incidences in the non reactive group.

Conclusion: Routine electronic monitoring is accepted in high risk women, but normal pregnancies too require some reliable objective assessment to optimize the outcome. This study suggests that the NST was found to be a good predictor of the healthy foetus even in normal pregnancies between 37-42 weeks of gestation and the probability of an adverse outcome such as meconium-staining of liquor and poor Apgar score increases with a non reactive strip. However large randomized controlled trials are necessary to assess normal pregnancies to incorporate NST to monitor normal pregnancies.

Keywords: Non stress test, Term pregnancy, 37-42 weeks, Perinatal outcome

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 and well fare. 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. A better understanding of fetal physiology and increasingly advanced technology have changed this laissez faire attitude towards the fetus. Antepartum assessment of fetal well being is one of the primary task of modern obstetrical practice.¹

The classic pregnancy term is between 37 and 42 weeks of gestation and the perinatal mortality and morbidity rates increases progressively during this period. In clinical practice, it is important and also very difficult to decide of an "ideal" time above which a medical intervention (induction of labour) brings more benefits than risks linked to the natural evolution of pregnancy. Both preterm (defined as delivery <37 week of gestation) and post term (delivery at or beyond 42 week of gestation) births are associated with increased neonatal morbidity and mortality.²

The main purpose of the various antepartum surveillance techniques is to detect fetal distress so as to prevent fetal death.³ It is the obstetrician's reassurance that the fetal heart rate patterns is normal and the nearby 100% certainty that the fetus is in a good position, which has made cardiotocography so attractive and has induced its widespread use. If the NST shows the baby is happy in his cosy little shell, there is no reason for labour induction.

Approximately, 50% of antepartum fetal deaths without apparent cause occur in patients without any risk factors. So a test to screen all the pregnancies should be developed. Traditionally, obstetricians tended to classify pregnant women as "low" and "high" risk. Although many well-organized methods are available for managing the high-risk group, we need more efficient methods for identifying pregnant women in distress in the low-risk group.⁴

The idea of taking this study using NST as a tool for routine antepartum fetal surveillance is to monitor the pregnancies otherwise considered normal, thus giving the best outcome in mothers.

Aims and Objectives

1. Assessment of fetal well being during antenatal period using NST in pregnancies between 37 to 42 weeks of gestation.
2. To study the role of NST in management of pregnancies between 37 to 42 weeks of gestation.
3. To study the correlation of NST with fetal outcome.

METHODS

Prospective hospital based study conducted in the Department of Obstetrics and Gynecology and Acharya Vinoba Bhave Rural Hospital Sawangi (Meghe) Wardha

over a period of 24 months (August 2011 to July 2013). This study was approved by Institution Ethics Committee.

Total 100 pregnant women volunteered and gave written consent (consent was taken in vernacular language) for the study and comprised the study population after following the inclusion criteria.

Inclusion criteria

Pregnant women with pregnancy from 37 weeks till 42 weeks of gestation with regular length of cycles and regular interval cycles.

Exclusion criteria

Pregnant mothers with high risk pregnancy and obstetric complications like multiple pregnancies, malpresentations, placenta previa, pre eclampsia, PIH (pregnancy induced hypertension), antepartum eclampsia, oligohydramnios, IUGR (intra uterine growth retardation), decreased fetal movements, PROM (pre mature rupture of membranes), third trimester bleeding, gestational DM (Diabetes Mellitus), Rh incompatibility, anemia, pregnant mothers whose dates were not confirmed, pregnant mothers who have irregular cycles, pregnant mothers who were in latent or active phase of labour, pregnant mothers who have been on recent hormonal birth control pills, patients who have had first trimester bleeding.

Procedure: At first counselling of the patient is done regarding the procedure. Detailed history was taken. Thorough General, systemic and obstetrical examination was done. Patients underwent routine investigations like haemoglobin, blood grouping, fasting blood sugar, post meal blood sugar, urine albumin (by dipstick), thyroid profile, sickling, HIV/HBsAg, Ultrasonography and were screened accordingly. Patients from 37 weeks and till 42 weeks were selected and were subjected to NST weekly from 37 weeks and the reading of that last weeks's strip was taken into account till she went into labour or had a strip showing non reactive reading and then she was subjected to biophysical profile score and decision was taken accordingly.

The NST was categorized as Reactive and Non Reactive. Reactive In a 20-minute period, two or more fetal heart rate accelerations of atleast 15 beats per minute above the baseline heart rate. Each acceleration lasts at least 15 seconds. Fetal movement may or may not be discernible by the patient. If the NST came out to be non reactive, NST was repeated for another 20 minutes and if it still remained Non reactive then Biophysical profile was done for that patient and decision was taken according to the result of the biophysical profile score. If Normal that patient was admitted and monitored thoroughly and if abnormal, decision for termination of pregnancy was taken.⁵

In this study, 41 completed weeks was opted for termination of the pregnancy.⁶

RESULTS

Table 1: Distribution of study group according to maternal age (yrs).

Age distribution	No. of Cases	%
18-20 years	15	15.00
21-30 years	83	83.00
> 30 years	2	2.00
Mean ± SD	24.18 ± 3.25	
Range	19-31 years	

As depicted in Table 2, there were 100 cases at the beginning of present study who underwent NST and 1 of the had a Non reactive NST for whom BPP was done which also was found to be abnormal and thus she was considered for delivery. Rest 99 cases were called again

for the next weekly NST out of which 9 patients spontaneously delivered and rest 90 were subjected to NST again, 88 of them had a reactive strip and 1 of them had an abnormal biophysical profile and the decision for delivery was taken for her. The rest 89 patients were called the next week out of which 30 spontaneously delivered and 59 patients were subjected to NST in that week. 57 of them had a reactive strip and only 2 had non reactive strip for whom biophysical profile was done out of which 1 had an abnormal BPP and thus she was considered for delivery. By EDD almost 40 patients had delivered spontaneously, left over 18 were subjected to NST for which 12 had Reactive NST and 6 had a Non reactive strip for whom BPP was done and 3 of which had an abnormal BPP and thus the decision for delivery was taken for them also. In the following week, 5 patients had spontaneously delivered out of which 10 were subjected to NST again and 6 had Reactive whereas 4 had non reactive strips and those patients with Non reactive NST were subjected to BPP and 3 of them had an abnormal BPP score for whom decision of delivery was undertaken. The rest of the 7 patients were also considered for termination of pregnancy.

Table 2: Distribution of study group according to gestational age (weeks) and NST.

GA (Weeks)	37 th completed Week		38 th completed Week		39 th completed Week		40 th completed Week		41 st completed Week	
No. of NST	1 st		2 nd		3 rd		4 th		5 th	
No of patients	100		99		89		58		15	
No of patients delivered spontaneously	0		9		30		40		5	
No of patients left undelivered	100		90		59		18		10	
NST R/NR	99	1	88	2	57	2	12	6	6	4
Abnormal BPP	1		1		1		3		3	

Table 3: Correlation of non reactive NST with biophysical profile score.

	Normal BPP	Abnormal BPP
NR NST (15)	6	9
%	40.00	60.00

Table 4: Correlation of non reactive NST and biophysical profile score with gestational age.

Parameter	Gestation <40 Weeks	Gestation > 40 Weeks	p-value
NST NR	5/15(33.33%)	10/15(66.66%)	0.14,NS, p>0.05
BPP Abnormal	3/9(33.33%)	6/9(66.66%)	0.34,NS, p>0.05

Table 4 shows the correlation of NST with BPP which shows that in gestation age >40 weeks the NR NST accounted for 66.66% of the cases and the BPP was found to be more abnormal (66.66%) in gestation age >40 weeks.

Table 5: Correlation between NST and mode of delivery.

NST	Normal	Instrumental	LSCS
Reactive (85)	54(63.53%)	2(2.35%)	29(34.11%)
Nonreactive (15)	5(33.33%)	3(20%)	7(46.66%)
Total(100)	59(59%)	5(5%)	36(36%)
κ ² -value	26.18		
p-value	P<0.0001, Significant		
Odds ratio	16.20(2.16-121)		

Table 5 shows correlation of NST with mode of delivery. 63.53% of the pregnant mothers with a reactive strip had vaginal delivery, 2.35% had instrumental delivery whereas 34.11% of the patients underwent caesarean section whereas 33.33% of the pregnant mothers with a non reactive strip had vaginal delivery, 20% had instrumental whereas 46.66% underwent caesarean section.

Table 6: Distribution of study group according to indications of LSCS.

Indications of LSCS	Reactive (29/85)		Non reactive (7/15)	
	No	%	No	%
Fetal distress	1	2.78	3	8.33
Failure of induction	5	13.89	1	2.78
Non progress of Labour	2	5.56	1	2.78
CPD	7	19.44	0	0.00
Contracted pelvis	10	27.78	1	2.78
PROM	3	8.33	1	2.78
APH	1	2.78	0	0.00

Table 6 shows the distribution of the study group according to the indications of LSCS. 8.33% of the NR NST group underwent LSCS for fetal distress. 27.78% of the LSCS in the reactive group were done for contracted pelvis.

Table 7: Correlation of NST with LSCS due to fetal distress.

	Reactive NST	Non reactive NST
LSCS due to fetal distress	1(25%)	3(75%)

Table 7 shows that 75% of the patients who underwent caesarean section due to fetal distress had preceding NR NST.

Table 8: Correlation of NST finding with meconium staining of liquor.

	Clear Liquor	Meconium Stained
Reactive(n=85)	78(91.76%)	7(8.24%)
Nonreactive (n=15)	10(66.67%)	5(33.33%)
Total	88(88%)	12(12%)
χ^2 -value	19.17	
p-value	P<0.0001, Significant	
Odd's Ratio	5.57(1.48-20.93)	

Table 8 shows that patients with reactive NSTs had 91.76% clear liquor and the patients with 33.33% of Non reactive NSTs patients had meconium staining of liquor.

Table 9: Correlation of NST with 1 min Apgar score.

	Apgar score >7	Apgar score <7
Reactive(n=85)	80(94.12%)	5(5.88%)
Non reactive(n=15)	7(46.67%)	8(53.33%)
Total	87(87%)	13(13%)
χ^2 -value	53.11	
p-value	P<0.0001, Significant	
Odd's Ratio	18.29(4.69-71.16)	

Table 9 shows the correlation of NST with Apgar score at 1 minute. 94.12% of the reactive strips had Apgar score >7 whereas 53.33% of the preceding non reactive strips had Apgar score <7 at 1 minute.

Table 10: Correlation of NST with 5 min Apgar score.

	Apgar score >7	Apgar score <7
Reactive(n=85)	82(96.47%)	3(3.53%)
Non reactive(n=15)	9(60%)	6(40%)
Total	91(91%)	9(9%)
χ^2 -value	37.76	
p-value	P<0.0001, Significant	
Odd's Ratio	18.22(3.87-85.66)	

Table 10 shows the correlation of NST with Apgar score at 5 minute. 96.47% of the reactive strips had Apgar score >7 whereas 40% of the preceding non reactive strips had Apgar score <7 at 1 minute.

Table 11: Distribution of study group on fetal birth weight.

	No of fetuses	%
Birth Weight <2.5 Kg	12	12.00
Birth Weight ≥ 2.5 Kg	88	88.00
Mean ± SD	2.66 ± 0.32 kg	

Table 11 shows the distribution of the study group according to the birth weight. 88% babies had birth weight >2.5 kg whereas 12 of the babies weighed <2.5 kg.

Table 12: Distribution of study group according to neonatal outcome and NST.

Neonatal Outcome	No of cases	R	NR
Birth Asphyxia	9	3(33.33%)	6(66.67%)
LBW	12	7(58.33%)	5(41.67%)
Meconium Aspiration Syndrome	4	1(25%)	3(75%)
Admission to NICU	13	4(30.76%)	9(69.23%)
Ventilator Support	4	1(25.0%)	3(75%)
Perinatal Mortality	0	0(0.00%)	0(0.00%)

Table 12 shows that there was no perinatal mortality in this study. Of the total, 9 children had birth asphyxia 66.67% cases had NR NST. 12 babies had low birth weight (<2.5 kg) out of which 5(41.67%) had non reactive strip. 4 children at birth had meconium aspiration syndrome out of which 75% had a non reactive NST. 13 babies were shifted to NICU, 69.23% babies had non reactive strip. 4 babies required ventilator support, 75% of them had a non reactive strip.

Table 13: Performance characteristics of non stress test for each fetal outcome parameter in percentage.

	Positive Predictive Value	Negative Predictive Value	Sensitivity	Specificity
Meconium Stained Liquor	33.33%	91.76%	41.67%	88.64%
Low 1 min Apgar Score	53.33%	94.12%	61.54%	91.95%
Low 5 min Apgar Score	40.00%	96.47%	66.67%	90.11%
Admission to NICU	51.43%	94.00%	71.44%	85.71%
Perinatal Mortality	0.00%	0.00%	0.00%	0.00%

DISCUSSION

The aim of antenatal fetal monitoring should be to identify these fetuses that are at risk or intrauterine death so that intervention can be done before damage occurs. A reactive NST is a reliable indicator of fetal well being in term fetus. The false negative rate of NST is defined as fetal death within 1 week of a reactive NST which is less than 1%.³ However, it is only one method of measurement and should not be used as a substitute for clinical judgment in the management of pregnancy.

That's why we have done biophysical profile after obtaining a non reactive NST in this study.

Schifrin et al⁷ found out that late decelerations during subsequent stress testing or labor, low Apgar scores, and perinatal deaths were more common in low-risk pregnancies than in high-risk pregnancies and more common in those with nonreactive NST than in those with reactive NST. Routine NST testing appears to improve the resolution of maternal risk classification and may contribute to better perinatal outcome.

In this study we had 85 % with reactive strips and 15% Non reactive strips out of the total no of 100 study subjects. In a study conducted by Phelan⁸ the NST interpretations were reactive (85.4%), nonreactive (14.0%), and unsatisfactory (0.6%).

Table 4 shows the correlation of NR NST and BPP with gestational age. We can see that 66.66% of the NR NSTS and Abnormal BPP scores were found in pregnant mothers with gestation age >40 weeks. Kunzel et al found out that as the pregnancy advances the chances of uteroplacental insufficiency increases the clinically significant cord compression would continue to jeopardize the fetal cardiovascular system.⁹ In a study conducted by Guidetti et al- When the study group delivering at 41 to 42 weeks were compared with the control group, the former had a statistically significant increase in the incidence of abnormal NSTs, oligohydramnios, Caesarean section for fetal distress, and admissions to the neonatal unit.¹⁰

Table 5 shows the correlation between NST finding and the mode of delivery. In the present study 34.11% of NST reactive and 46.66% of the non-reactive NST patients underwent LSCS, 2.35% of the reactive NSTs and 20% of Non-reactive NST patients had instrumental delivery. In study of Eden et al (1988), 23.2% delivered by caesarean section with reactive NST and 37.7% with non-reactive NST.¹¹

In present study 4 out of 36 patients underwent LSCS for fetal distress out of which, 75% patients had preceding Non-reactive NSTs and 25% had reactive NSTs as depicted in table 7.

Phelan (1981)⁸ conducted a study in high risk pregnancies using NST and found out while the reactive group experienced a favorable fetal outcome, the nonreactive group demonstrated a significant increase in the overall cesarean section rate, the rate of cesarean sections for fetal distress, and the perinatal mortality rate. Based on their experience, the NST continues to be a valuable procedure for the assessment of fetal well-being in their high-risk pregnancies.

Table 8 shows correlation of NST with meconium stained liquor 33.33% of non-reactive NST had meconium stained liquor compared to 8.24% of reactive NST. The

difference is statistically significant. MSAF is a predictor of adverse fetal outcome even in low risk pregnancy so it has been taken as one of the variables predicting fetal outcome. Meconium aspiration syndrome occurs in about 10.5% of neonates born with MSAF and carries a mortality of 12%. Of the patients with MSAF one had thick meconium and baby 4 had meconium aspiration syndrome.

Frequency of Meconium stained liquor in various studies.	Meconium stained liquor in Non-reactive NST
Schifirin (1979) ⁷	39.1 %
Patil (1993) ¹¹	34 %
Imam Bano et al (2012) ¹²	42.8%
Present study	33.33%

A low one minute Apgar score does not correlate with infants future outcome. A 5-minute Apgar score particularly change in score between 1 and 5 min is a useful index of effectiveness of resuscitation efforts. Long term neurological correlation is obtained at 5 min score which is of more value. This is in correlation to the findings of Rochard et al¹⁴ and Schifirin et al⁷ which shows poor perinatal outcome in the babies with low Apgar scores .

As shown in table 10, in patients with reactive NST, good Apgar score at 5 min i.e. >7 was found in 96.47% and <7 in 3.53%. Whereas, in the non-reactive group there were 60% with low Apgar scores, 40% have good Apgar score at 5 min i.e. >7.

In the study of Eden et al (1988)¹¹ good Apgar score was observed in 98% cases. With reactive NSTs, only 1.9% had poor Apgar with NST reactive test. Rogar et al (1988) found that non-reactive NST is associated with significant increase of mortality and morbidity this was also confirmed by Lawrence D. Devoe et al (1987).¹⁵ In a study conducted by Imam Bano et al¹² the Apgar score <7 at 5 minutes was 3.4% in the reactive NST group whereas 42.8% in the non reactive group which is quite similar to this study. We also found that non-reactive NST is significantly related to poor Apgar score and reactive NST to good Apgar score (P<0.001).

Kelly and Kulkarni¹⁶ found a decrease in neonatal mortality that they attributed in part to earlier recognition and treatment of fetal distress. They estimated a 44% potential saving among monitoring. Neutra et al¹⁷ compared a monitored group vs. an unmonitored group and received the outcome of 15,846 babies. They found that the death rate among the unmonitored high risk group was 304/1000 among those monitored. Another survey of the representative reports of mortality associated with the NST shows after subtracting for

deaths from unpredictable causes, the rate of perinatal death following normal or reactive tests is low when the intrinsic high risk nature of these populations is taken into consideration. The major sources of unexpected and /or non preventable are (1) abruption placentae (2) major anomalies (3) cord accidents (4) neonatal complications of pre-term births. These sources account for approximately 60% of perinatal deaths.

In a study by Imam Bano et al¹³, 31.8% of the babies with reactive NST had Low birth weight, whereas 42.8% of the babies had low birth weight. 3.6% of the pregnant mothers with reactive NST required NICU admission, whereas 28.5% of the pregnant mothers with Non reactive strip required NICU admission.

Table 13 shows the performance characteristics of NST as a test in for each fetal outcome parameter.

In the present study it was found out that the negative predictive value of NST for meconium stained fluid was 91.76% comparable to 90.9% in study of Imam Bano et al¹³ In a study conducted by Khooshideh et al¹⁸ the sensitivity and specificity Of non stress test for prediction stained amniotic fluid was 62% and 42% respectively.

The negative predictive value for low 1 minute apgar score was found out to be 94.12% whereas the specificity was found out to be 91.95% in comparison to 92.85% and 84.78% in a study conducted by Bhide et al.¹⁹

Also the negative predictive value for low Apgar score at 5 minutes was 96.47% and specificity in our study which was 90.11% comparable to 98.8% and 90.6% respectively found out by Imam Bano et al¹³ and 95.23% and 83.33% in a study conducted by Bhide et al.¹⁹

In this study negative predictive value and specificity for admission to NICU was 94% and 85.71% whereas Bhide et al¹⁹ had a negative predictive value to be 92.85% and a specificity of 86.66% in comparison to this study.

CONCLUSION

The major goal of antepartum fetal surveillance in normal pregnancies without any risk factor is an appropriate and timely identification of fetuses at risk of morbidity and mortality and thus unnecessary delay in intervention can be avoided and hence a better perinatal outcome could be achieved. An equally important goal is to avoid unnecessary intervention in an uncompromised fetus.

The non reactive NST does not indicate the fetal status and subsequent perinatal outcome accurately. This non reactive NST should be supported by other antenatal fetal surveillance techniques prior to obstetric intervention.

Routine electronic monitoring is accepted in high risk women, but normal pregnancies too require some reliable objective assessment to optimize the outcome. This study

suggests that the NST was found to be a good predictor of the healthy foetus even in normal pregnancies between 37-42 weeks of gestation and the probability of an adverse outcome such as meconium-stained amniotic fluid and asphyxia increases with a non reactive strip. It is evident from this study that NST is a useful tool to avoid obstetric litigation as parental expectation of a good outcome is extremely high. However large randomized controlled trials are necessary to incorporate NST to monitor normal pregnancies.

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