

# Comparative Study of Foetal Colour Doppler versus Non-Stress Test as a Predictor of Perinatal Outcome in High Risk Pregnancy

## Abstract

**Aim & Objectives:** To study the perinatal outcome in high risk pregnancy by comparative analysis of Foetal colour Doppler and non-stress test.

**Material & Methods:** This comparative study carried out on 100 antenatal patients of >34 weeks pregnancy in the Department of Obstetrics & Gynaecology S.N. Medical College Agra. All patients were subjected to colour Doppler and non-stress test after doing routine examination and investigations.

**Result:** In our study it was found that, in high risk group 36% had normal NST while 64% had abnormal. In control group 82% had normal NST while 18% shows abnormal NST. In Doppler study 52% were having abnormal findings suggestive of foetal hypoxia and 48% cases had normal Doppler in high risk group while in control group 96% cases had normal findings. On comparing NST and colour Doppler, it was found that where both NST and Doppler were abnormal, Doppler showed changes earlier than NST giving a significant lead time of up to 8 days with an average of 5 days. This lead time is very important as foetus can be delivered in this period or can be followed up to gain a little more pulmonary maturity or steroid prophylaxis can be administered during this period in preterm foetuses.

**Conclusion:** We concluded that Doppler is useful in recognising foetal compromise earlier than NST, giving a lead time which is important in management of preterm high risk pregnancies, Doppler depicts chronic hypoxic changes while NST can detect acute events in presence or absence of chronic hypoxia. An abnormal NST following an abnormal Doppler is associated with worst perinatal outcome. NST still holds its importance because of its ease of use, low cost and minimal time required. On the other hand Doppler requires sophisticated equipments, operative skills and experience.

**Keywords:** NST (non-stress test); Doppler; FHR( foetal heart rate); BPP (Bio-physical profile); MBPP (modified biophysical profile)

## Research Article

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**Abbreviations:** NST: Non-Stress Test; FHR: Foetal Heart Rate; BPP: Bio-Physical Profile; MBPP: Modified Biophysical Profile; BFM-800: BiosysFetal Monitor; RI: Resistance Index; VAS: Vibro Acoustic Stimulation

## Introduction

The desire of every women contemplating motherhood is that her pregnancy culminates in a healthy offspring who will achieve the highest possible physical and mental potential. Assessment of the foetal wellbeing is done by various biophysical methods. But the problem of sample collection, accuracy and need for laboratory technology and personnel have made biochemical methods of foetal monitoring less favourable than biophysical methods. Non stress test (NST) is most commonly used for antepartum evaluation of foetal status. It is easy, non-invasive, easily performed and interpreted method by which can identify nearly twice as many foetuses with an abnormal foetal heart rate pattern than intermittent auscultation of foetal heart rate [1]. The use of Doppler ultrasonography for the evaluation of the foetal circulation is based on physical principal i.e. the frequency of sound wave change when reflected from a moving object and proportional to the velocity of moving object (Doppler Effect) [2].

It is a non-invasive tool that has proven useful in the evaluation of maternal and foetal haemodynamic.

The aim of the antepartum monitoring is to detect foetal hypoxia at the earliest in order to prevent subsequent acidemia and brain damage. Antepartum foetal asphyxia is an important cause of still birth and neonatal death [3].

## Objective

To study the Foetal monitoring by non-stress test and Foetal colour Doppler in high risk pregnancy.

## Material and Methods

This comparative study carried out on 100 antenatal patients of >34 weeks pregnancy in Department of Obstetrics & Gynaecology S.N. Medical College Agra. Out of 100 patients 50% were having high risk pregnancy like pre-eclampsia, intrauterine growth retardation, Diabetes mellitus, Post dated pregnancy, Oligohydramnios, Anaemia, Heart disease and elderly Prima. All patients were subjected to colour Doppler and non stress test after doing routine examination and investigations. NST was performed by using the Biosysfetal monitor (BFM-800). Test was carried out for 20 min. The patients were placed in semi-fowler's

position to avoid compression over the venacava and supine hypotension syndrome.

The NST were recognized reactive when two or more foetal heart rates accelerations of at least 15 beats per minute and lasting at least 15 seconds from baseline to baseline clearly recorded during 20 min. If no spontaneous foetal movement occurred during the initial 20 min. of observation the test was continued for another 20 min. and during this period foetal movement is provoked by external manipulation. If no acceleration was found in 40 min. then test was considered non-reactive [3,4]. During interpretation of NST four aspects foetal heart rate were traced (Baseline foetal heart, Variability of foetal heart rate, Presence or absence of accelerations and Deceleration) [3-5]. Foetal colour Doppler was conducted on Toshiba colour Doppler machine having a biconvex abdominal probe of 3.5 MHz frequency.

The vessels which were scanned were:

- a) Fetal Umbilical artery
- b) Fetal Middle cerebral artery
- c) Fetal Thoracic aorta

The indices which were calculated were-

Resistance index (RI) = S-D/S

Doppler study was considered abnormal when:

- I. -RI of umbilical artery and foetal thoracic artery > 2SD for the gestational age [4].
- II. -RI of middle cerebral artery <5<sup>th</sup> percentile for the gestational age.
- III. -Presence or absence of end diastolic flow or reversal of end diastolic flow in umbilical artery.
- IV. -Presence of brain sparing effect in middle cerebral artery.

### Observation

In primigravida there were high risk cases in 40% and in multigravida 60% high risk cases (Table 1). According to study high risk cases were seen maximum in between 20-25 years of age (40) %. In high risk group mean period of gestation was 37.34 weeks out this 48% were in between 34-37 weeks and 44% were

in between 38-40 weeks of gestation. Out of all high risk cases 50% were pre-eclampsia, 20% IUGR, 20% severely anaemic (Table 1). Among the high risk factors majority of them belonged to pre-eclamptic toxemia in 50%, IUGR in 20%, severe anaemia in 20%, Diabetes in 2%, Heart disease in 2%, Oligohydramnios in 4%, and elderly prima in 2%.

In our study it was found that, in high risk group 36% had normal NST while 64% had abnormal. In control group 82% had normal NST while 18% shows abnormal NST. In Doppler study 52% were having abnormal findings suggestive of fetal hypoxia and 48% cases had normal Doppler in high risk group while in control group 96% cases had normal findings.

All foetuses were categorised in four sub-groups according to their NST and Doppler findings-

- 1) Group A – NST-Reassuring + Colour Doppler -normal
- 2) Group B- NST-Non Reassuring + Colour Doppler -normal
- 3) Group C- NST-Reassuring + Colour Doppler -foetal hypoxia
- 4) Group D- NST- Non Reassuring + Colour Doppler -foetal hypoxia

Presence of meconium stained liquor was more common in group D, 16 out of 20 i.e. 80% (p value for Group AVs D = 0.015 while for Group B Vs D= 0.008) (Table 2). On statistical analysis it was found that the rate of caesarean section were significantly higher (p=0.011) on comparison of group D with group A but not as on comparison of group D with group B (p=0.357) (Table 3), p value (Group B with D) = 0.357. In group D caesarean section was deferred when neonatal survival prospects were poor. It was observed that Apgar scores both at 1 min. and 5 min. were lower in high risk group when compared to control group. The mean Apgar score at 1min. was 5.34 in high risk group and 7.56 in control group. The mean Apgar at 5 min. was 7.14 in high risk and 8.9 in control group. (Group A vs D p value = 0.945) (Table 4).

There were max. NICU admissions when both NST and Doppler were abnormal, group D. (75%), as compared to just 15.5% in group A, 23.07% in group B and 60% in group C. We found that NICU admission were 100% in both group C and D in high risk group. There are total 5 death in high risk group while 1 in control group. (p value Group A Vs D- 0.0012, Group B Vs D- 0.2216) (Table 5).

Table 1: Maternal characteristics.

Maternal Characteristics	Control (n=50)	High Risk (n=50)
Primiparity	22 (44%)	30 (60%)
Multiparity	28 (56%)	20 (40%)
Maternal Age (years)	26.8	28.5
Gestational Age (weeks)	37.8	37.4
<b>High Risk-</b>		
PIH		25 (50%)
FGR		12 (24%)
Anemia		05 (10%)
Other		08 (16%)

Control group n=50; High risk group n=50

**Table 2:** Presence of Meconium Stained Liquor in Relation to Nonstress Test and Color Doppler Imaging.

Sub-group	High Risk Group					Control Group				
	No.	Clear		MSL		No.	Clear		MSL	
		No.	%	No.	%		No.	%	No.	%
<b>Group-A:</b> NST-Reassuring Color Doppler-normal	13	8	61.5	5	38.4	40	35	87.5	5	12.5
<b>Group-B:</b> NST-Non-reassuring Color Doppler- Normal	12	8	66.6	4	33.3	8	6	75.0	2	25.0
<b>Group-C:</b> NST- Reassuring Color Doppler- Fetal Hypoxia	5	1	20	4	80.0	1	0	0	1	100
<b>Group-D:</b> NST-non reassuring, Color Doppler- hypoxia	20	4	20.0	16	80.0	1	0	0	1	100

**Table 3:** Mode of delivery.

Subgroups	High Risk Group					Control Group				
	No	Vaginal Delivery		Caesarean Section		No.	Vaginal Delivery		Caesarean Section	
		No.	%	No.	%		No.	%	No.	%
<b>Group-A:</b> NST- Reassuring Colour Doppler- Normal	13	12	92.3	1	7.6	40	40	90	4	10
<b>Group-B:</b> NST-Non-reassuring Colour Doppler- Normal	12	8	66.6	4	33	8	8	88	1	13
<b>Group-C:</b> NST-Reassuring Colour Doppler- Fetal hypoxia	5	3	60	2	40	1	1	0	1	##
<b>Group-D:</b> NST-non reassuring Colour Doppler- Fetal hypoxia	20	10	50	10	50	1	1	0	1	##

**Table 4:** Mean Apgar Scor in Relation to Non-stress Test and Color Doppler.

Subgroup	High Risk Group			Control Group		
	No.	Mean at 1 min	Mean at 5 min	No.	Mean at 1 min	Mean at 5 min
<b>Group-A:</b> NST- reassuring Colour Doppler- normal	13	6.6	8.1	40	7.9	9
<b>Group-B:</b> NST-non-reassuring Colour Doppler-normal	12	5.2	6.7	8	6.6	8.3
<b>Group-C:</b> NST-reassuring Colour Doppler fetal hypoxia	5	5.8	7.8	1	4	6
<b>Group-D:</b> NST-Non- reassuring Colour Doppler Fetal Hypoxia	20	4	5.2	1	2	0

**Table 5:** Mean Apgar Score (5 min.), NICU Admission and Perinatal Mortality in Relation to NST and Color Doppler.

Test	High Risk Group				Control Group			
	No.	Mean Apgar (5 min.)	NICU Admission	Perinatal Deaths	No.	Mean Apgar (5 min.)	NICU Admission	Perinatal Deaths
<b>Group-A:</b> NST- reassuring Colour Doppler- normal	13	8.1	2 -15.5%	-	40	9	2 -5%	-
<b>Group-B:</b> NST- non-reassuring Colour Doppler- normal	12	6.7	3 -23.07%	-	8	8.3	2 -25%	-
<b>Group-C:</b> NST-reassuring Colour Doppler- fetal hypoxia	5	7.8	3 -60%	1	1	6	1 -100%	0
<b>Group-D:</b> NST- non-reassuring Colour Doppler- fetal hypoxia	20	5.2	15 -75%	4	1	0	1 -100%	1

**Table 6:** Sensitivity, specificity, positive predictive value and negative predictive value of NST and Colour Doppler in Prediction of poor perinatal outcome.

	Non Stress test (%)	Colour Doppler (%)
Sensitivity	76	72.4
Specificity	60	80
Positive Predictive Value	55.8	84
Negative Predictive Value	62.5	68

## Discussion

FHR reactivity, spontaneous or obtain on VAS (vibro acoustic stimulation) is a solid indicator of foetal health and absence of acidosis. Definition of reactivity is modified for women with 24-32 weeks pregnancy and NST is accepted as reactive if the peak of acceleration reaching of at least 10 beats per minute for 10 seconds [5]. The variables that must be evaluated in the NST are [3-5]-

- i. Baseline FHR
- ii. Variability of FHR
- iii. Presence /absence of accelerations
- iv. Presence /absence of decelerations

False negative rate of NST is 3.2/1000 [1]. MBPP (Modified Bio-Physical Profile-NST with VAS plus Amniotic Fluid Volume) is excellent test for evaluation of foetal wellbeing [6]. Ott [7] studied the single Doppler parameter MCA/UA S/D ratio in comparison with NST to predict the neonatal compromise in a larger group of 447 cases and concluded that combination of NST and MCA/UA PI was excellent predictor of perinatal outcome [7]. On comparing NST and colour Doppler, it was found that where both NST and Doppler were abnormal, Doppler showed changes earlier than NST giving a significant lead time of up to 8 days with an average of 5 days [6,8]. This lead time is very important as babies can be delivered in this period or can be followed up to gain a little more pulmonary maturity or steroid prophylaxis can be administered during this period in preterm fetuses.

On statistical analysis it was found that the rate of caesarean section were significantly higher ( $p=0.011$ ) on comparison of group D with group A but not as on comparison of group D with group B ( $p=0.357$ ) (Table 3). In group D caesarean section was deferred when neonatal survival prospects were poor. In Padmagirison et al. [8] study also the caesarean delivery rate was found to be 56.2% in group D where both tests were abnormal [8].

## Conclusion

We concluded that Doppler is useful in recognising foetal compromise earlier than NST, giving a lead time which is important in management of preterm high risk pregnancies, Doppler depicts chronic hypoxic changes while NST can detect acute events in presence or absence of chronic hypoxia [5,6,8]. An abnormal NST following an abnormal Doppler is associated with worst perinatal outcome [9,10] (Table 6). NST still holds its importance because of its ease of use, low cost and minimal time required. On the other hand Doppler requires sophisticated equipments, operative skills and experience.

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