Original Research Article

Study of validity of combining non stress test and doppler velocimetry in predicting adverse perinatal outcome in high-risk pregnancies among patients attending a tertiary care centre in south India

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Abstract

Background: To find out the validity of combining non stress test and doppler velocimetry in predicting adverse perinatal outcomes in high risk pregnancies. **Method:** A longitudinal observational study conducted in the department of OBG in Pushpagiri Institute of Medical Sciences and Research Centre. In this study 83 pregnant women >34 weeks gestation, with risk factors like PIH, FGR, Anaemia, Diabetes, were included. Women were interviewed (using semi structured interviewer administered questionnaire) and systematically examined. NST was done biweekly and doppler study of the umbilical and middle cerebral artery was performed every one to three weeks (depending on the severity of the risk). Based on the results the women were categorized into 4 groups. These women were followed up till delivery and outcomes were noted. **Results:** It was found that, when both Doppler and non-stress test were normal, the outcomes were significantly better, on the contrary when both were abnormal the adverse outcomes were considerably high. **Conclusion:** It is found that none of the two monitoring methods used alone is superior to the other, thereby by combining the two, and acting appropriately, significantly better outcomes could be achieved.

Keywords: Doppler velocimetry, Non stress test, High-risk pregnancies.

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INTRODUCTION

Extensive anatomical, physiological and biochemical changes occur during pregnancy. But at any stage of pregnancy, these changes can go wrong which will lead to dreadful feto-maternal complications. With the advancing technologies, the diagnosis and monitoring of high-risk pregnancies has become effortless. Cardiotocography (used synonymously with NST in this article), real time ultrasonography and doppler velocimetry are commonly used to evaluate foetal wellbeing. NST is based on the principle that a well oxygenated foetus responds to spontaneous and induced movements with foetal heart accelerations. This reflects normally functioning autonomic nervous system and excludes cellular hypoxia. Cardiotocograph is the equipment required for this test, foetal activity is recorded on a graph by means of external transducers. The test is considered reactive when baseline heart rate is between 110-160 bpm, beat to beat variability is between 5-25 beats/minute, and there are 2 accelerations of 15 or more beats lasting at least 15 seconds, with no decelerations in 20 minutes. If these criteria are not met in 20minutes, recording time is extended to 40minutes –

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Extended NST. If criteria are still unmet, the test is considered as nonreactive. Doppler velocimetry aims to evaluate blood flow in the vessels supplying the placenta and foetus. The blood vessels targeted most often for Doppler evaluation in pregnancy are the uterine arteries in mother and umbilical and the middle cerebral arteries in the foetus. The indices commonly used for analysis of the Doppler waveform is the PI, RI, S/D Ratio and Cerebro Placental Ratio (MCA/UA). Although with the advancing technologies, the antepartum foetal surveillance has become much easier, but most of the times a combination of tests rather than single test result is considered for decision making in case of high-risk pregnancy, because each test reflects different aspects of maternal and foetal pathophysiology. Hence the objective of this study is to focus on validity of combining non stress test and doppler velocimetry in predicting adverse perinatal outcome in high risk pregnancies so that appropriate decision can be taken to prevent perinatal morbidity and mortality at the earliest.

MATERIALS AND METHODS

STUDY DESIGN

This is a longitudinal observational study.

STUDY SETTING

Department of Obstetrics and Gynaecology, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala.

STUDY POPULATION

Primigravidae /multigravidas >34 weeks gestation those who fall into the category of high-risk pregnancies considering the inclusion and exclusion criteria.

SAMPLE SIZE

A sample size of 16 mothers in each group will be sufficient to detect 47.28% difference in NICU admission with 80% power and 5 % level of significance.

SAMPLING TECHNIQUE

Random consecutive sampling.

INCLUSION CRITERIA

Primigravidae /multigravidas >34 weeks gestation with risk factors like anaemia, Gestational hypertension, Preeclampsia, Gestational diabetes, Suspected IUGR.

EXCLUSION CRITERIA

1. Pregnancies with gestational age < /= 34 weeks.
2. Uncomplicated pregnancies >34 weeks.

METHODOLOGY

This study was conducted in 83 eligible patients, primigravidae /multigravidas >34 weeks gestation those who fall into the category of high-risk pregnancies considering the inclusion and exclusion criteria, in Pushpagiri Institute of Medical Sciences and Research Centre. Patients who satisfy the inclusion criteria were randomly assigned into the study groups. History of the women was taken using semi structured interviewer administered questionnaire after obtaining consent from patient. General physical and systemic examination of all women included in the study was be done. NST was done biweekly and doppler velocimetry was performed every one to three weeks (depending on the severity of the risk). Women were followed up till delivery and outcomes were analysed in terms of APGAR score, low birth weight and NICU admissions. NST was done using Cardiotocography machine from BPL LTD. Doppler velocimetry was assessed using ultrasound machine Wipro GE LOGIQ S7 EXPERT from GE health care limited. Data entry was done using Microsoft Excel and analysed using SPSS 20.0. A sample size of 16 mothers in each group will be sufficient to detect 47.28% difference in NICU admission with 80% power and 5% level of significance. Depending upon the test reports women were grouped into:

Group 1 - Doppler normal and NST reactive.
Group 2 - Doppler normal and NST non-reactive.
Group 3 - Doppler abnormal and NST reactive.
Group 4 - Doppler abnormal and NST non-reactive.

MH Chi square was calculated. P value of <0.05 will be statistically significant.

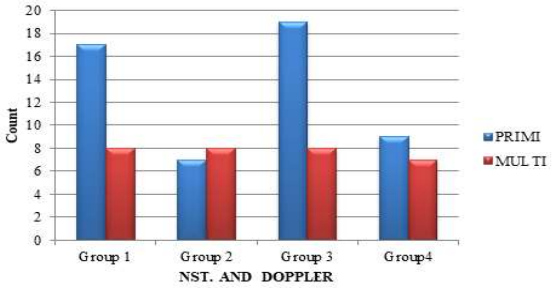
RESULTS

The graphical representation, analysis and inference with respect to different study variables are as follows

1) PARITY

Table 1: NST and Doppler * Parity Crosstabulation

			Parity		Total
			1	2	
NST and Doppler	1	Count	17	8	25
		% within NST and Doppler	68.0%	32.0%	100.0%
	2	Count	7	8	15
		% within NST and Doppler	46.7%	53.3%	100.0%
	3	Count	19	8	27
		% within NST and Doppler	70.4%	29.6%	100.0%
	4	Count	9	7	16
		% within NST and Doppler	56.3%	43.8%	100.0%
Total		Count	52	31	83
		% within NST and Doppler	62.7%	37.3%	100.0%



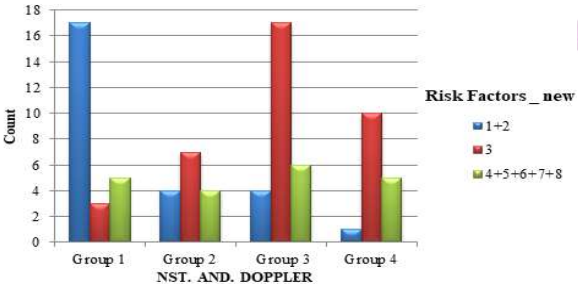
Graph 1: Association between NST, Doppler and Parity

In our study 62.7% were primis and 37.3% were multis, but this association was not found to be statistically significant.

2) RISK FACTOR

Table 2: NST and Doppler * Risk Factor Crosstabulation

			Risk Factor			Total
			1	3	4	
NST and Doppler	1	Count	17	3	5	25
		% within NST and Doppler	68.0%	12.0%	20.0%	100%
	2	Count	4	7	4	15
		% within NST and Doppler	26.7%	46.7%	26.7%	100%
	3	Count	4	17	6	27
		% within NST and Doppler	14.8%	63.0%	22.2%	100%
	4	Count	1	10	5	16
		% within NST and Doppler	6.3%	62.5%	31.3%	100%
Total		Count	26	37	20	83
		% within NST and Doppler	31.3%	44.6%	24.1%	100%

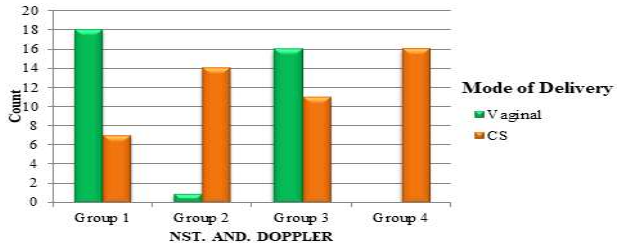


Graph 2: Association between NST, Doppler and Risk Factor

3) MODE OF DELIVERY

Table 3: NST and Doppler * Mode of Delivery Crosstabulation

			Mode of Delivery		Total
			1	2	
NST and Doppler	1	Count	18	7	25
		% within NST and Doppler	72.0%	28.0%	100.0%
	2	Count	1	14	15
		% within NST and Doppler	6.7%	93.3%	100.0%
	3	Count	16	11	27
		% within NST and Doppler	59.3%	40.7%	100.0%
	4	Count	0	16	16
		% within NST and Doppler	0.0%	100.0%	100.0%
Total		Count	35	48	83
		% within NST and Doppler	42.2%	57.8%	100.0%



Graph 3: Association between NST, Doppler and Mode of Delivery

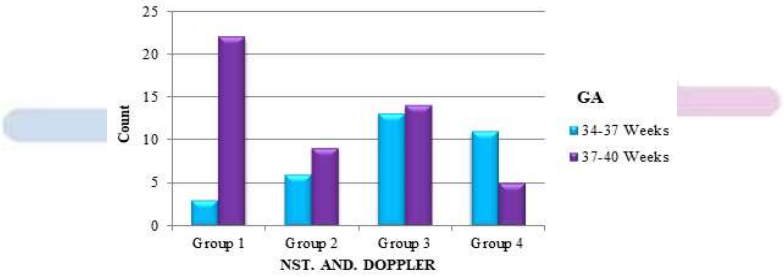
Inference

Out of 25 patients where both NST and Doppler were normal 72% of them were delivered vaginally, whereas among 16 patients whose NST and Doppler were abnormal 100% were delivered by CS. p value is <0.001 which is highly significant.

4) GA

Table 4: NST and Doppler * GA Crosstabulation

			GA		Total
			1	2	
NST and Doppler	1	Count	3	22	25
		% within NST and Doppler	12.0%	88.0%	100.0%
	2	Count	6	9	15
		% within NST and Doppler	40.0%	60.0%	100.0%
	3	Count	13	14	27
		% within NST and Doppler	48.1%	51.9%	100.0%
	4	Count	11	5	16
		% within NST and Doppler	68.8%	31.3%	100.0%
Total		Count	33	50	83
		% within NST and Doppler	39.8%	60.2%	100.0%

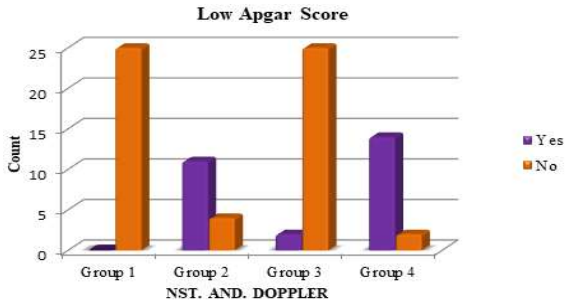


Graph 4: Association between NST, Doppler and Gestational Age

5) LOW AGPAR SCORE

Table 5: NST and Doppler * Low Apgar Score Crosstabulation

			Low Apgar Score		Total
			1	2	
NST and Doppler	1	Count	0	25	25
		% within NST and Doppler	0.0%	100.0%	100.0%
	2	Count	11	4	15
		% within NST and Doppler	73.3%	26.7%	100.0%
	3	Count	2	25	27
		% within NST and Doppler	7.4%	92.6%	100.0%
	4	Count	14	2	16
		% within NST and Doppler	87.5%	12.5%	100.0%
Total		Count	27	56	83
		% within NST and Doppler	32.5%	67.5%	100.0%

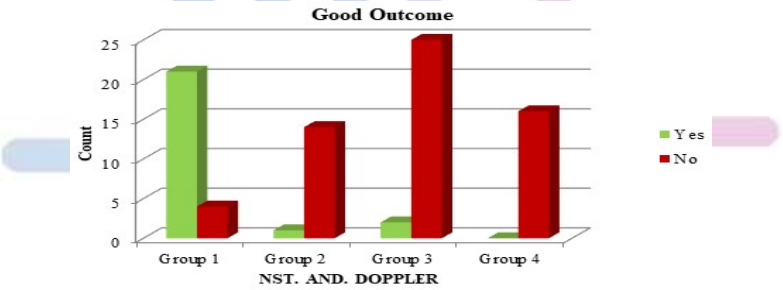


Graph 5: Association between NST, Doppler and Low Apgar Score

6) GOOD FETAL OUTCOME

Table 6: NST and Doppler * Good Outcome Crosstabulation

			Good Outcome		Total
			1	2	
NST and Doppler	1	Count	21	4	25
		% within NST and Doppler	84.0%	16.0%	100.0%
	2	Count	1	14	15
		% within NST and Doppler	6.7%	93.3%	100.0%
	3	Count	2	25	27
		% within NST and Doppler	7.4%	92.6%	100.0%
	4	Count	0	16	16
		% within NST and Doppler	0.0%	100.0%	100.0%
Total		Count	24	59	83
		% within NST and Doppler	28.9%	71.1%	100.0%

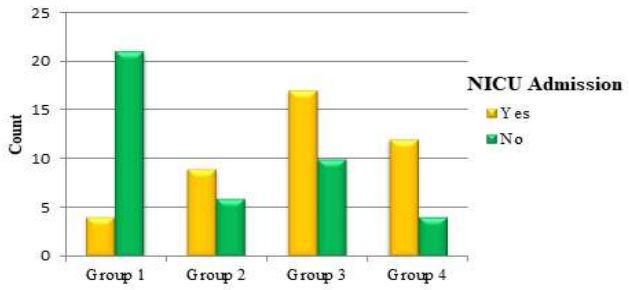


Graph 6: Association between NST, Doppler and Good Foetal Outcome

7) NICU ADMISSION

Table 7: NST and Doppler * NICU Admission Crosstabulation

			NICU Admission		Total
			1	2	
NST and Doppler	1	Count	4	21	25
		% within NST and Doppler	16.0%	84.0%	100.0%
	2	Count	9	6	15
		% within NST and Doppler	60.0%	40.0%	100.0%
	3	Count	17	10	27
		% within NST and Doppler	63.0%	37.0%	100.0%
	4	Count	12	4	16
		% within NST and Doppler	75.0%	25.0%	100.0%
Total		Count	42	41	83
		% within NST and Doppler	50.6%	49.4%	100.0%

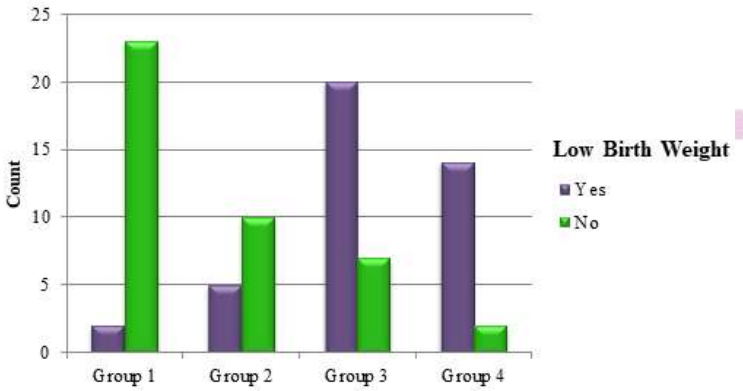


Graph 7: Association between NST, Doppler and NICU Admission

8) LOW BIRTH WEIGHT

Table 8: NST and Doppler * Low Birth Weight Crosstabulation

			Low Birth Weight		Total
			1	2	
NST and Doppler	1	Count	2	23	25
		% within NST and Doppler	8.0%	92.0%	100.0%
	2	Count	5	10	15
		% within NST and Doppler	33.3%	66.7%	100.0%
	3	Count	20	7	27
		% within NST and Doppler	74.1%	25.9%	100.0%
	4	Count	14	2	16
		% within NST and Doppler	87.5%	12.5%	100.0%
Total		Count	41	42	83
		% within NST and Doppler	49.4%	50.6%	100.0%



Graph 8: Association between NST, Doppler and Low Birth Weight

DISCUSSION

For past twenty years NST has been the mainstay of antenatal surveillance, but more recently usage of ultrasound doppler velocimetry for surveillance of high-risk pregnancies has steeply increased. Hence many investigators have sought to find out which is more superior. Our study is an effort in the same direction. We have tried to find the validity of combining both the tests. It was found that out of 25 patients where both NST and Doppler were reactive 72% delivered vaginally. On the contrary among 16 patients whose NST and Doppler were abnormal 100% were delivered by CS which is in agreement with other similar studies[1,2,8]. This clearly shows that when both NST and Doppler were abnormal the chance of CS is much higher. Among 25% who had both NST and Doppler normal 88% were delivered at term. When both NST and Doppler are reactive it is definitely a good indicator of foetal wellbeing. But when both NST and Doppler were abnormal 68.8% were delivered prematurely. Low APGAR score, low birth weight and need for NICU admission among these babies very high. When both NST and Doppler were abnormal 87.5% babies had low AGPAR score. Among 25 patients who had both NST and Doppler normal only 16% had NICU admission. On the contrary when both were abnormal 75% had NICU admission. Among 16 patients who had both NST and Doppler nonreactive 87.5% had low birth weight. Most of the cases of Group 3 and 4 were complicated by maternal

hypertension followed by FGR and diabetes in pregnancy. While few investigators have found that Doppler velocimetry is better than NST in picking up the cases which are at high risk of poor perinatal outcome[6,7,8,10], the others are of the opinion that NST is better than doppler velocimetry particularly in GDM cases[3]. Whereas in our study we have found that combining both the tests will increase the predictive value for detecting high risk cases and also aid in deciding on the timing of delivery. As both these tests have different pathophysiological basis, none can be regarded as superior over other. Both can used to complement each other and thereby increasing the efficacy[1.7,9].

CONCLUSION

When both doppler and NST were normal the perinatal outcome was definitely good and chances of low APGAR score, low birth weight and NICU admissions were low. When NST was reactive and Doppler were abnormal alone, it is not always an indication for immediate termination. Depending upon the risk factors, the Doppler should be performed everyone to three weeks. When Doppler was normal and NST was non-reactive, it is always ideal to repeat the NST before an immediate termination is been planned. But if repeated NSTs are non-reactive, appropriate decision to be taken. But when both NST and Doppler were nonreactive, it was associated with high perinatal morbidity. Most of the babies were delivered prematurely. Low APGAR score, low birth weight and need for NICU admission among these babies very high. Hence by combining the two, and acting appropriately, the incidence of adverse perinatal outcome may be reduced.

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