Comparison of foetal doppler vs non stress test as a predictor of adverse perinatal outcome in preeclampsia and iugr patients

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ABSTRACT

Antepartum foetal surveillance techniques is to detect foetal distress so as to prevent fetal morbidity and mortality from utero-placental insufficiency due to maternal risk factors, placental disorders or foetal disease. This study was undertaken to observe the Doppler flow velocity in the umbilical artery, uterine artery and middle cerebral artery compared with NST to predict perinatal outcome in high risk pregnancies (Preeclampsia and IUGR).

Objectives :- To study and compare the efficacy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value of non-stress test (NST) and Doppler velocimetry, its relation to predict adverse perinatal outcome and to calculate the lead time that is when abnormal doppler was followed by abnormal NST.

Materials and Methods: It was a prospective study conducted in the Department of Obstetrics and Gynecology in SMGS Hospital GMC Jammu over a period of 1 year in 100 cases from 1st November 2021 to 31st October 2022after approval from institutional review board. All pregnant women beyond 30 weeks period of gestation who were attending OPD or indoor patients in SMGS HOSPITAL diagnosed with preeclampsia or IUGR or both and confirming to inclusion criteria were enrolled and observed in study. Written and informed consent was taken from all patients and data was recorded in case report form .They were investigated with NST and doppler and were divided into groups according to results. The results of these tests were correlated with adverse perinatal outcome.

Results: The study showed that after comparing the APGAR scores and NICU admissions and neonatal deaths of Group A (both NST and doppler were normal) with that of other groups, it was found that there was a statistic difference which points out that babies in Group B, C and D were more compromised implying that adverse perinatal outcome should be considered if any of the test is abnormal. On comparison of perinatal outcome in different groups it was found that fetal compromise in terms of deaths, meconium, APGAR <7 and NICU admissions was greater when both Doppler and NST were abnormal that is in Group D. When babies of women with only an abnormal Doppler (Group B) were compared to those of women with only an abnormal NST (Group C) it was seen that Group B had better perinatal outcome suggesting the fact that NST reflects changes late in the course of disease process.

Conclusion: The study concluded that though each of the individual tests was effective in predicting adverse perinatal outcome, the significant advantages of Doppler over NST observed in our study in Group D were that Doppler showed changes earlier than NST giving a lead time having more diagnostic accuracy in predicting adverse perinatal outcome. The fetal compromise was greater when both Doppler and NST were abnormal.

Keywords: Doppler, Non stress test, Preeclampsia, IUGR

INTRODUCTION

Hypertensive disorders represent the most common medical complications of pregnancy affecting between 7% and 15% of all gestations and account for approximately a quarter of all antenatal admissions**.[1]** The incidence of preeclampsia ranges between 2% and 7% in healthy nulliparous women**.[2]**Preeclampsia is strongly associated with fetal growth restriction (FGR), low birth weight (LBW), spontaneous iatrogenic preterm delivery, respiratory distress syndrome (RDS), admission to neonatal intensive care unit (NICU) and cerebral palsy.**[3]**FGR represents the second primary cause of perinatal mortality accounting to 30% of stillbirths, besides determining a higher frequency of preterm births and intrapartum asphyxia.**[4]**The aim of antepartum monitoring in these patients is to detect fetal hypoxia at the earliest in order to prevent subsequent acidemia and brain damage.

There are many tests available today each with its advantages and disadvantages. Non stress test (NST) is the most widely used test and it reflects oxygenation of brain. Doppler plays an important role in FGR pregnancies where hemodynamic rearrangements occur in response to fetal hypoxemia.The goal is to detect fetal distress to prevent fetal morbidity and mortality from uteroplacental insufficiency, maternal risk factors, placental disorders or fetal disease.

The NST works on the principle of intact neurologic coupling between the fetal central nervous system and fetal heart.**[5]**In late gestation, a healthy fetus usually exhibits on an average 3 to 4 accelerations above the baseline FHR, every hour. These accelerations average 20-25 bpm in amplitude and approximately 40 sec in duration.**[5].**But it is proposed that hypoxemia and acidemia induce an alteration of brainstem centres which are regulating the activity of the pacemaker cells of the heart, thereby altering the NST trace. The NST is most predictive when reactive. This predictive value is prevalent over a week.

The Doppler evaluation in obstetrics involves assessment of various vessels of the fetus each has its own significance. In case of preeclampsia, the uterine artery (UA) velocimetry has a better predictive value than the umbilical artery, with the exception of cases that had growth restricted fetus.**[6]**It is recommended to incorporate uterine artery and umbilical artery surveillance of pregnant women with IUGR, hypertension and diabetic women with vascular disease**.[7]**The NST is simpler, less invasive, less time consuming and less expensive. Whereas Doppler changes occur with reduction in fetal growth at a time when other fetal wellbeing tests are still being normal.

The color doppler study is a better tool to detect the IUGR**[7].** A fetus with severe growth restriction first demonstrates changes in the umbilical artery as decreased end diastolic flow and then in the middle cerebral artery (MCA) as increased end diastolic flow. This is followed by alterations in the venous circulation, including the ductus venosus (decreased forward flow during atrial systole) and the umbilical vein (pulsatile flow). Doppler ultrasound of the ductus venosus and MCA provides information about the hemodynamic status of a growth restricted fetus. One should look at the PI of Uterine artery with a value >95th percentile for gestational age considered to be abnormal**[8]** . The PI of uterine arteries >95th percentile associated with EFW or with AC/EFW <10th percentile is used to diagnose early onset FGR. The Umbilical artery doppler is used to assess the feto-placental perfusion. As early as 14 weeks, low impedance in the umbilical artery permits continuous forward flow through cardiac cycle**[9].** Maternal or placental conditions that obliterate small muscular arteries in the placental tertiary stem villi result in the changes that commence with an increased UA resistance (increased S/D ratio) and progress to absent end-diastolic flow and finally reversed end-diastolic flow. The changes are characterised by an increase in PI and RI which may not manifest until 50% of placental vasculature is blocked. Reversed end diastolic

flow in the umbilical artery circulation represents an advanced state of placental compromise and has been associated with obliteration of >70% of the arteries in the placental tertiary villi**[10].**In Middle cerebral artery under normal conditions, the cerebral circulation is a high impedance circulation with continuous forward flow present throughout the cardiac cycle**[11].** Brain sparing reflex, is characterised by an increased end diastolic flow velocity (reflected by a low PI) in the middle cerebral artery. Doppler assessment of the brain sparing can also be assessed with the cerebro placental ratio, defined as middle cerebral artery PI/ umbilical artery PI. A fetus is considered to have fetal brain sparing when this ratio is <5th percentile for gestation age**.[12]**

AIMS AND OBJECTIVES

1. To study and compare the efficacy, sensitivity, specificity, positive predictive value and negative predictive value of NST and Doppler velocimetry.
2. Its relation to predict adverse perinatal outcome.
3. To calculate the lead time that is when abnormal Doppler was followed by abnormal NST.

METHOD

The study was conducted in Department of obstetrics and gynaecology in SMGS Hospital GMC Jammu (Jammu & Kashmir,India)which is a Tertiary care teaching hospital. Data was collected after the institutional review board approval. All the pregnant women beyond 30 weeks period of gestation who were attending OPD or indoor patients in SMGS Hospital diagnosed with preeclampsia or IUGR or both and confirming to inclusion criteria were enrolled in the study. Written and informed consent was taken from all patients and data was recorded in case report form from over 1 year and sample size was 100 patients. Detailed medical history and general physical examination was done.Maternal investigations were done which includes blood pressure, pulse, weight, Pedal oedema. Routine baseline hematological investigations were done including CBC, RFT, LFT, Coagulogram and Urine for Albumin etc.

INCLUSION CRITERIA:

Singleton pregnancies beyond 30 weeks period of gestation with preeclampsia, FGR or with both preeclampsia and FGR and with cephalic presentation will be included in the study.

EXCLUSION CRITERIA

- Pregnancies with

a) Below 30 weeks period of gestation
b) Multiple pregnancies
c) Abruptio placenta
d) Eclampsia
e) Anemia
f) Severe heart disease
g) Rh isoimmunization
h) Patients presenting in latent or active phase of labor
i) Any congenital anomalies in fetus as diagnosed by USG

In those pregnancies beyond 30 weeks of gestation and fitting in inclusion criteria, Doppler waveform will be obtained at weekly or biweekly interval depending upon severity.Various parameters were calculated that is fetal biometry, AFI and estimated fetal weight.The vessels

studied will be Umbilical artery, Middle cerebral artery and uterine artery. The interpretation of these differs with fetal hemodynamics. The systolic/diastolic(S/D) ratio, pulsatility index or PI (systolic-diastolic velocity/mean velocity) and resistance index or RI (systolic-diastolic velocity/systolic velocity) are other indices which are used to measure the resistance to blood flow in the vessel. PI of umbilical and middle cerebral artery were measured and CPR ratio calculated. It is calculated as PI MCA/PI UA. The normal CPR is 1.0 and is almost constant in last 10 week of pregnancy. CPR<1.0 is associated with adverse perinatal outcome.

- Doppler was considered abnormal when any of following parameters were met:

a) Pulsatility index of UA >95th percentile for gestation age
b) Absence or reversal of end diastolic flow in UA
c) Pulsatility index of MCA<5th percentile for gestation age
d) Abnormal cerebroplacental ratio PI MCA /UA < 1.08
e) Presence of brain sparing effect in MCA.

Nonstress test was done on bed for 20min. The characteristics studied are: Baseline rate, baseline variability, accelerations and decelerations. It was considered reactive when there was two or more foetal heart accelerations of at least 15 beats per minute and lasting at least 15 sec from base line (110-160) with baseline variability of 5-25.Acidosis is unlikely with a normal trace with accelerations.If no spontaneous foetal movement occurred during 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 accelerations were found during 40 min the test was considered non- reactive.

STUDY OUTCOME

- Based upon the findings four subgroups were formed

1. Group A - NST reassuring + DOPPLER normal
2. Group B - NST reassuring+ DOPPLER Abnormal
3. Group C - NST non reassuring + DOPPLER normal
4. Group D- NST non reassuring + DOPPLER Abnormal

- Adverse perinatal outcome was considered if any one or more of following will be present

a) Perinatal death
b) Meconium stained liquor
c) APGAR < 7 at 5 min
d) NICU admissions for reasons other than low birth weight like birth asphyxia, sepsis, RDS, feeding intolerance, convulsions, hypoglycemia, hyperbilirubinemia, ventilatory support and necrotising enterocolitis.
e) Neonatal seizures within first 24 hrs to 48 hrs of birth
f) Fetal distress and Caeserean section

RESULTS AND STATISTICAL ANALYSIS

The data was compiled in Microsoft excel worksheet and was interpreted by using SPSS version 23.The results of continuous variables are expressed as mean± SD, median or range as appropriate. Qualitative data was represented in frequency and percentage. Discrete variables comparison between different groups was done with Chi square test or Fischer's exact test.Continuous variables in different groups were compared with Student t-test (for 2 groups) or with one way analysis of variance (for >2 groups).All statistical tests were two sided and were performed at significance level of $p < 0.05$.A p value <0.05 was considered statistically significant and p value <0.001 was considered highly significant. Sensitivity,

specificity, positive predictive value and negative predictive value were calculated for comparison between groups.

Age (in years)	**Mean**	**Number**
19-21 yrs	20	4
26-29 yrs	23.73	21
26-29 yrs	27.45	54
> 30 yrs	32.73	21
Parity	**Number (100)**	**Percentage**
Primigravida	48	48 %
Gravida 2	30	30 %
Gravida 3	16	16 %
Gravida 4	5	5 %
Gravida 5	1	1 %
Gestational age (weeks)	**Number (100)**	**Percentage**
30-32 weeks	1	1 %
32weeks1d – 34weeks	12	12 %
34weeks1d – 36weeks	29	29 %
>36weeks	58	58 %
Risk factors	**Number (100)**	**Percentage**
PREECLAMPSIA	60	60
IUGR	62	62
BOTH	19	19

Table 1: Demographic characteristics in study patients

Most of the females, 54 (54%) were in the age group of 26-29 years with mean age of 27.4 years ranging from 19 to 37 years. There were 48 (48%) primigravida followed by multigravida 52 (52%) patients. Most of the patients presented at gestational age more than 36 weeks that is 58 (58%) followed by 34weeks1day to 36weeks that is 29 (29%) followed by 32weeks1day to 34weeks that is12 (12%) followed by 30weeks to 32weeks that is1 (1%). 60 patients were labelled as preeclampsia according to criteria and 62 patients were diagnosed as cases of IUGR. There were 19 patients who were cases of both preeclampsia and IUGR.

CORRELATION BETWEEN NST, DOPPLER PARAMETERS AND PERINATAL OUTCOME

In our study out of 100 patients 64 cases (64%) were reported as having a normal/ reassuring NST while 36 cases (36%) were reported as having abnormal/ non reassuring NST. NST was reported as non-reassuring after 40 min of tracing

Perinatal outcome		**Normal**	**Abnormal**	**P-value (correlation)**
Neonatal Outcome	IUGR	34	27	0.000000000003347 (0.5747052)
	Death	4	10	
APGAR at 5 min	>7	58	22	0.0005422 (0.3494123)
	<7	6	14	
NICU admission	Admission	21	28	0.0000278 (0.4233338)
	No Admission	43	8	
Meconium	Yes	2	12	0.000038

	No	62	24	
Overall Neonatal complications	Yes	21	28	0.0000278 (0.4233338)
	No	43	8	

Table 2: NST correlation with perinatal outcome.

It was found that in 64 cases where NST was reported as normal there were 4 neonatal deaths, 6 neonates were having APGAR score of less than 7 after 5 minutes, 2 neonates had meconium and there were 21 NICU admissions. In 36 cases where NST was reported as abnormal there were 10 neonatal deaths, 14 neonates had APGAR <7 after 5 min,12 neonates had meconium and there were 28 NICU admissions. Overall in 64 cases where NST was normal there were 21 neonates who had perinatal complications (32.8%) while 43 neonates had no perinatal complications (67.1%). Similarly, in 34 cases where NST was abnormal, 28 (82.3%) neonates had perinatal complications while 8 (23.5%) neonates had no perinatal complications. The p value was 0.02586 which was statistically significant which means that NST has a role in predicting adverse perinatal outcome.

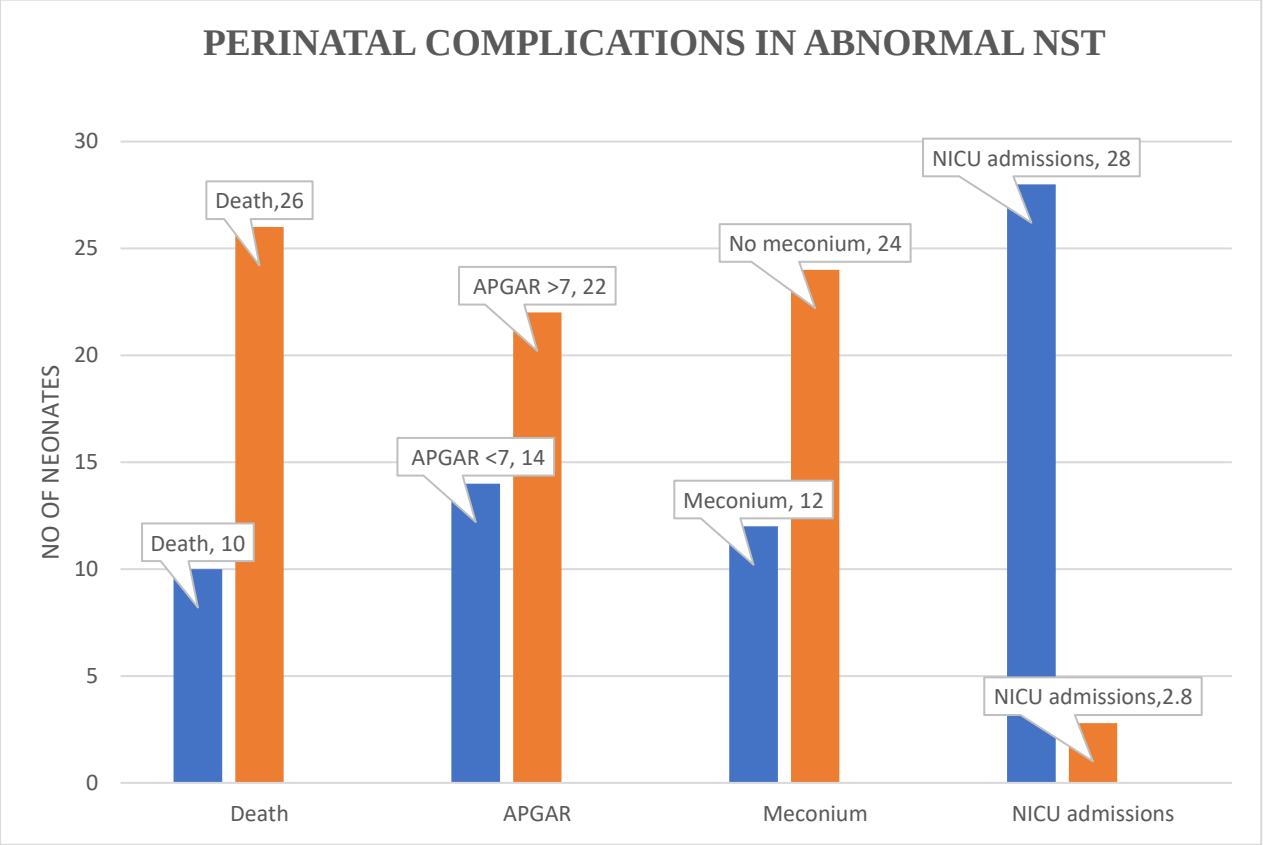

Fig. 1: Bar chart showing number of neonates having perinatal complications in Abnormal NST

In my study out of 100 patients 44 were reported as having normal doppler that is normal doppler flow in umbilical artery, uterine arteries and middle cerebral artery. In 56 patients doppler was reported as abnormal. The S/D ratio was normal in 61 patients and increased in 38 patients. The pulsatility index of umbilical artery was normal in 88 patients and increased in 12 patients. The end diastolic flow was normal in 53, reduced in 7, absent in 32 and

reversal in 8 patients. The MCA PI was normal in 85 patients and increased in 15 patients. The uterine arteries PI was normal in all patients.

Perinatal outcome		Normal	Abnormal	P-value (correlation)
Neonatal Outcome	IUGR	49	12	0.0001351 (0.3988645)
	Death	1	13	
APGAR at 5 min	>7	43	37	0.000000006722 (0.5826946)
	<7	1	19	
NICU admission	Admission	10	39	0.0003809 (0.3589025)
	No Admission	34	17	
Meconium	Yes	6	6	0.0000024
	No	38	50	
Overall Neonatal complications	Yes	10	39	0.0003809 (0.3589025)
	No	34	17	

Table 3: Doppler correlation with Perinatal outcome:

In my study it was found that in 44 patients where Doppler was normal there was only 1 neonatal death, 1 neonate had APGAR <7 at 5 minutes, 6 neonates had meconium and 10 NICU admissions. In 56 patients where Doppler was abnormal, there were 13 neonatal deaths, 19 neonates had APGAR <7 after 5 minutes, 6 neonates had meconium and there were 39 NICU admissions. It was found that in 44 cases where Doppler was normal there were 10 neonates who had perinatal complications (22.7%) while 34 neonates had no perinatal complications (77.2%). Similarly, in 56 cases where Doppler was abnormal, 39 (69.6%) neonates had perinatal complications while 17 (30.3%) neonates had no perinatal complications. The p value was 0.0006338 which was statistically significant which means that Doppler has a role in predicting adverse perinatal outcome.

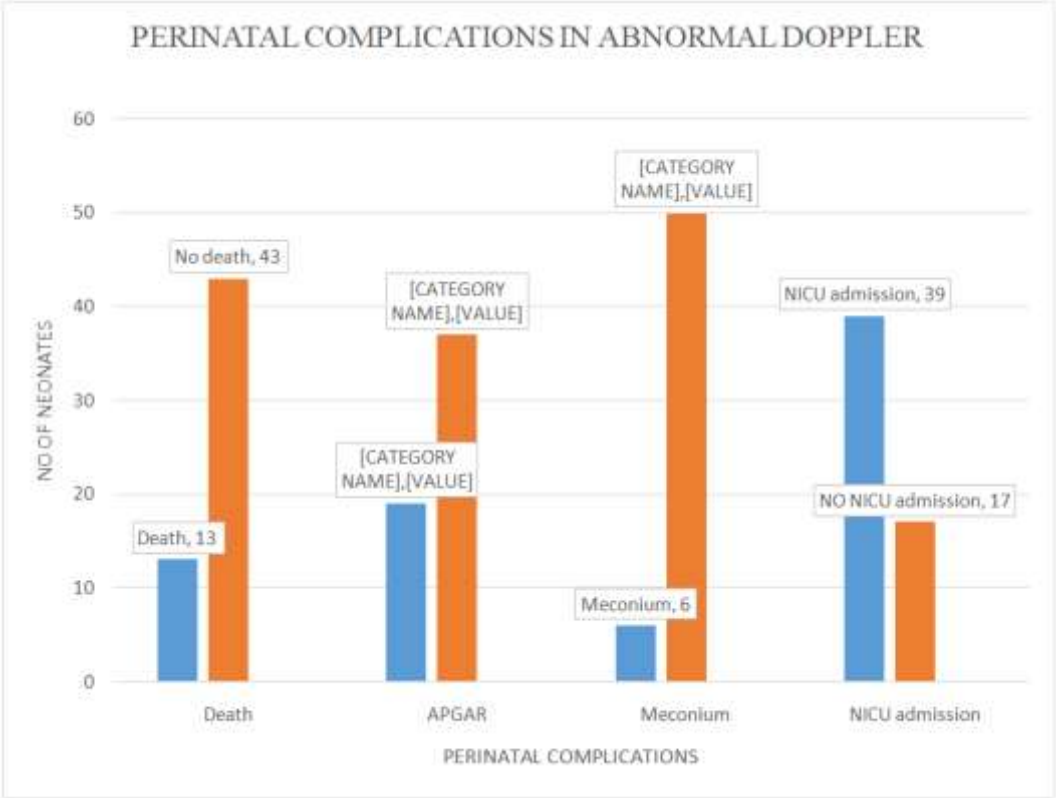

Fig. 2: Bar chart showing number of neonates having perinatal complications in Abnormal Doppler

NST	No Perinatal Complications	Perinatal complications	Total	P value
Normal	43	21	64	0.02586
Abnormal	8	28	36	
Doppler				
Normal	34	10	44	0.02586
Abnormal	17	39	56	

Table 4: Prediction of adverse perinatal outcome via NST and Doppler

PERINATAL OUTCOME IN FOUR GROUPS

It was found that maximum no of patients 36 were falling in Group B that is where NST was normal and Doppler was abnormal followed by 28 patients in Group A where NST and Doppler were normal followed by 20 patients in Group D where NST and Doppler were abnormal followed by 16 patients in Group C where NST was abnormal and Doppler was normal.

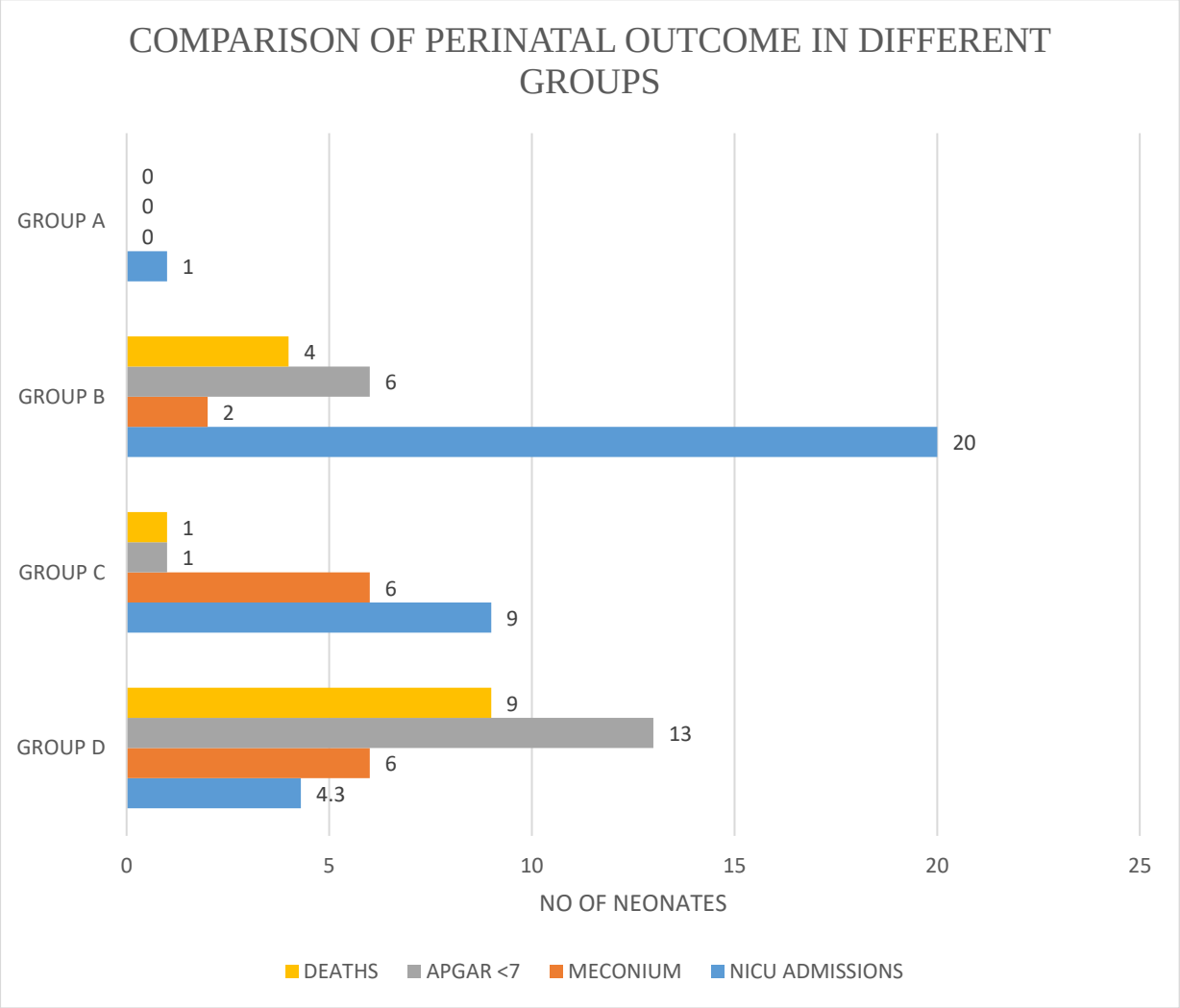

Fig 3: Perinatal Outcome in different Groups

In my study it was found that in Group A there was 1 NICU admission out of 28 patients, no neonate had meconium and there were no neonatal deaths.In Group B out of 36 patients, 20 had NICU admissions, 2 neonates had meconium and there were 4 neonatal deaths.In Group C out of 16 patients, 9 had NICU admissions, 6 neonates had meconium and there was 1 neonatal death.In Group D out of 20 patients, 19 were admitted in NICU, 6 neonates had meconium and there were 9 neonatal deaths.On comparison of perinatal outcome in different groups it was found that fetal compromise in terms of deaths, meconium, APGAR <7 and NICU admissions was greater when both Doppler and NST were abnormal that is in Group D.

Variable	NST	DOPPLER
Sensitivity	57%	60%
Specificity	83%	97%
NPV	66%	58%
PPV	77%	93%
Accuracy	70% 95% CI:	84%, 95% CI:

	(60.34-0.7921)	(73.97- 91.1)

Table 5: Comparison of efficacy of NST vs Doppler as diagnostic tests

In my study it was found that sensitivity of NST was 57%, specificity 83%.The PPV was 77% and NPV was 66%. Diagnostic accuracy was 70% with 95% confidence interval ranging from 60.34 to 79.21. Also the sensitivity of Doppler was 60%, specificity 97%. The PPV was 93% and NPV was 58%. Diagnostic accuracy of Doppler was 84% with 95% confidence interval ranging from 53% to 73%.

MODE (Group A)	**VAGINAL**	**ELECTIVE LSCS**	**EMERGENCY LSCS**
TOTAL=28	22	4	2
MODE (Group B)			
TOTAL=36	6	1	29
MODE (Group C)			
TOTAL=16	2	1	13
MODE (Group D)			
TOTAL=20	0	0	20

Table 6: Mode of delivery in various groups

In my study it was found that in Group A where NST was normal and Doppler was normal out of 28 patients 22 had vaginal deliveries followed by 4 patients undergoing elective LSCS. There were only 2 patients who underwent emergency LSCS. The reason for elective LSCS were obstetrics indications and reason for emergency LSCS was fetal distress in labour.

In Group B where NST was normal and Doppler was abnormal out of 36 patients maximum number of patients that is 29 underwent emergency LSCS followed by 6 patients having vaginal delivery. There was only 1 patient who had an elective LSCS. The major reason for emergency LSCS was IUGR with color doppler changes.

In Group C where NST was abnormal and Doppler was normal maximum number of patients that is 13 underwent emergency LSCS followed by 2 patients having vaginal delivery followed by 1 patient undergoing elective LSCS.The major reason for emergency LSCS was non reassuring fetal heart rate and out of 13 cases 6 neonates had meconium stained liquor while 2 had decreased liquor.

In Group D where both NST and Doppler were abnormal out of 20 patients all 20 underwent emergency LSCS.

Calculation of lead time

It is the interval between period of gestation at which Doppler got abnormal at first time and period of gestation at which NST got abnormal. It was seen in only Group D whereas in Group B,babies were delivered even before NST had become abnormal and therefore no lead time. It was seen in 20 patients of Group D. The lead time was ranging from 4 to 11 days with an average of 4.6 days.

DISCUSSION

On assessing foetal Doppler and NST in a group of women with high risk pregnancy comprising of FGR and/or Preeclampsia it is evident that when both NST and Doppler are abnormal, the baby weight and gestational age at birth are low and perinatal mortality and neonatal morbidity are high. Though both test results were effective in predicting abnormal outcome, the significant advantage of doppler over NST observed in my study in Group D was that doppler showed changes earlier than NST giving a significant lead time of up to 11 days with an average of 4.6 days. This lead time has got a significance as babies can be

delivered in this period or can be followed up in this interim period to gain a little more pulmonary maturity, which may be crucial for a preterm foetuses. Antenatal steroids can be administered during this period in preterm foetuses.

Similarly, in the current study the significant lower birth weight of foetuses when both Doppler and NST are abnormal (Group D) indicates that these foetuses suffer from a more severe degree of placental insufficiency. Though Doppler was abnormal in both B and D groups, perinatal outcome was better in Group B. When neonatal survival prospects are good it is better to deliver the compromised foetuses than to monitor till the development of abnormal NST as is evident from the perinatal outcome in Group B. These babies were less compromised and were relatively more advanced in gestation. So, early intervention was possible.

Most of the females, were in the age group of 26-29 years with mean age of 27.4 years ranging from 19 to 36 years. There were 48 patients who were primigravida and there were 52 patients who were multigravida. Most of the patients presented at gestational age more than 36 weeks that is 58%. There were 60 patients who had preeclampsia as risk factor and 62 patients had IUGR as risk factor. There were 19 patients who had both preeclampsia and IUGR. 64 patients were reported as having a normal/ reassuring NST while 36 were reported as having abnormal/ non reassuring NST. The p value of NST in predicting adverse perinatal outcome was 0.02586 which was statistically significant. In this study 44 were reported as having normal doppler, that is normal doppler flow in umbilical artery, uterine arteries and middle cerebral artery and in 56 patients doppler was reported as abnormal. The p value was 0.0006338 which was statistically significant which means that Doppler has a role in predicting adverse perinatal outcome.

In this study it was found that 36 patients were falling in Group B that is where NST was normal and Doppler was abnormal followed by 28 patients in Group A where NST and Doppler were normal followed by 20 patients in Group D where NST and Doppler were abnormal followed by 16 patients in Group C where NST was abnormal and Doppler was normal. Thus, after comparing the APGAR scores and NICU admissions and neonatal deaths of Group A with that of other groups , it was found that there was a statistic difference which points out that babies in Group B, C and D were more compromised implying that adverse perinatal outcome should be considered if any of the test is abnormal. On comparison of perinatal outcome in different groups it was found that fetal compromise in terms of deaths, meconium, APGAR <7 and NICU admissions was greater when both Doppler and NST were abnormal that is in Group D. When babies of women with only an abnormal Doppler (Group B) were compared to those of women with only an abnormal NST (Group C) it was seen that Group B had better perinatal outcome suggesting the fact that NST reflects changes late in the course of disease process.

64% of patients underwent emergency LSCS followed by 30% vaginal deliveries followed by 6% patients who underwent elective LSCS. Considering the mode of delivery Group D had the majority of operative deliveries for suspected fetal compromise and this difference was statistically significant. The difference in the number of cesarean deliveries for Group B and Group C with that of Group D was statistically significant, suggesting that the number of LSCS increased when both the tests of well being were abnormal in comparison to only one test being abnormal.

The sensitivity of NST was 57%, specificity 83%, PPV was 77% and NPV was 66%. Diagnostic accuracy was 70% with 95% confidence interval ranging from 60% to 79%. It was seen that specificity of NST was more than sensitivity indicating that it is more predictive of healthy fetus.

The sensitivity of Doppler was 60%, specificity 97%, PPV was 93% and NPV was 58%. Diagnostic accuracy of Doppler was 84% with 95% confidence interval ranging from 53% to 73%. The sensitivity and specificity of Doppler was more than that of NST indicating that Doppler is more predictive of adverse perinatal outcome.

Combined fetal testing modalities such as Doppler, NST and biophysical profile provide very important information regarding fetal health. Integrated fetal testing would be ideal for individualised care of thepreterm compromised fetus for timed intervention.

Padmagirison [13] et al conducted a a prospective study in 55 antenatal women beyond 30 weeks of gestation complicated with severe preeclampsia and IUGR .There were 29 cases with abnormal doppler and 20 with abnormal NST. Doppler abnormalities preceded NST changes. The average time interval between abnormal doppler and abnormal NST called as the lead time was 4.14 days. There were 10 perinatal deaths out of which 6 were from group where both tests were abnormal. It was concluded that doppler identifies fetal compromise earlier than NST.

Yelikar [14] et al concluded that both doppler and NST have better specificity and negative predictive value than their sensitivity and positive predictive value indicating both tests were more effective in predicting normal healthy fetus, the fetal compromise was greater when both tests were abnormal and when NST was abnormal the fetuses were more compromised than when only doppler was abnormal suggesting doppler detects changes earlier than NST.

Gomathi [15] et al concluded that there were 38 women in group 1 where NST and doppler were normal, 25 in group 2 where NST was normal and doppler was abnormal ,7 in group 3 where NST was abnormal and doppler normal and 20 in group 4 where both were abnormal. Highest perinatal mortality was seen in group 4 (12/20) (60%) where both tests were abnormal. Majority of women showed Doppler abnormality prior to changes in NST.

Choudhary [16] et al conducted a prospective cross sectional study in 100 pregnant women beyond 34 weeks of gestation with one or more high risk factors. It was concluded that PIH was the most common etiology of high risk pregnancy. Doppler was better in predicting fetal compromise in comparison to NST in high risk pregnancies. Normal NST and normal doppler were not statistically different in prediction of fetal outcome. Abnormal doppler value was better in predicting fetal compromise in comparison to abnormal NST. Cerebroplacental ratio was very accurate and was good predictor of adverse perinatal outcome

CONCLUSION

The study concluded that though each of the individual tests was effective in predicting adverse perinatal outcome, the significant advantages of doppler over NST observed in our study in Group D were that Doppler showed changes earlier than NST giving a lead time having more diagnostic accuracy in predicting adverse perinatal outcome. The fetal compromise was greater when both Doppler and NST were abnormal. Moreover, when only NST was abnormal, the fetuses were more compromised than when only Doppler was abnormal. This suggests that Doppler detects changes earlier in the disease process than NST.

We observed that in cases with normal doppler, a sudden abnormal NST indicates acute hypoxia. In cases of abnormal doppler if the chances of neonatal survival are good it is better to deliver the fetus before NST becomes abnormal. Hence it is concluded that both tests are complementary to one another in the fetal surveillance and no single test should be considered for decision making because each test reflects different aspects of maternal and fetal pathophysiology. The choice of test can be dictated by the clinical scenario.

LIMITATIONS

It was hospital based, had small sample size and there were no control populations. As present study was done in a teaching institution and different scans are done by different radiologists, hence there might be an inter observer variations. The aim of future research should be to minimize the risks of fetal morbidity and mortality further by the optimal timing of delivery.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest concerning this paper, as well as the published research results, including the financial aspects of conducting the research, obtaining and using its results, as well as any non-financial personal relationships.

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