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Role of nonstress test in improving the perinatal outcome in pregnancies complicated by preeclampsia

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Abstract

Introduction: Antepartum fetal surveillance is the assessment of fetal well being in utero before the onset of labour. It helps in early detection of fetuses at risk, so that timely management can prevent further deterioration, thereby reducing perinatal morbidity / mortality. Around 10-30% of the mothers seen in antenatal period can be classified as high risk but they account for 70-80% of perinatal mortality / morbidity.

Aim And Objectives: The role of NST in management of pregnancies complicated by preeclampsia and comparison of maternal and perinatal outcome in patients of preeclampsia undergoing NST and without NST.

Material and Methods: Present study was carried out in 100 patients of preeclampsia with singleton pregnancy, cephalic presentation of more than 32 weeks period of gestation. Group I (cases) – 100 patients of preeclampsia in whom NST was done. Group II (controls) – retrospective analysis of medical records of 100 patients of preeclampsia in the past 1 year where NST was not done.

Results: The mean age of women in group I was 24.63±3.63 years and 24.53±3.74 in group II. 4. Maximum number of women i.e. 59% in group I and 55% in group II were primi para ($p > 0.05$). Majority of women were admitted at 37-38 weeks period of gestation i.e. 40% in group I and 38% in group II ($p > 0.05$). Out of 100 women in group I who were subjected to nonstress tests, a total of 68(68%) women were found to have reactive NST while 32(32%) women had non-reactive NST. Thirty two non-reactive NST cases were further subjected to BPP out of which 26(81.25%) were normal and 6(18.75%) were associated with abnormal BPP. Twenty six patients who had normal BPP, were followed up with weekly BPP. Out of 68 NST reactive cases, forty six (67.64%) women delivered vaginally and 22(32.35%) underwent cesarean section and in non-reactive 32 cases, nine (28.12%) women delivered vaginally and 23(71.87%) women underwent cesarean section which is statistically significant ($p < 0.05$). Sixty (88.23%) newborns in reactive NST group had normal birth weight and 19(59.37%) newborns in non-reactive NST group had normal birth weight which is statistically significant ($p < 0.05$). Apgar score $> 7/10$ at 1 & 5 minutes was found in 64(94.11%) newborns in reactive NST group and 22(73.33%) newborns in non-reactive NST group which is statistically significant ($p < 0.05$). Nine (13.23%) newborns were admitted in reactive NST group and 17(56.66%) in non-reactive NST group.

Conclusion: The major goal of antepartum fetal surveillance is an appropriate & timely identification of fetuses at risk of morbidity and mortality & thus unnecessary delay in interventions 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.

Keywords: Nonstress test, perinatal outcome, preeclampsia

Introduction

Antepartum fetal surveillance is the assessment of fetal well being in utero before the onset of labour. It helps in early detection of fetuses at risk, so that timely management can prevent further deterioration, thereby reducing perinatal morbidity / mortality.

Nonstress test is a simple, non invasive test performed in pregnancies over 32 weeks of gestation to measure the heart rate of the fetus in response to its own movements. Healthy babies respond with an increased heart rate during times of movement and the heart rate decreases at rest. The concept behind a non-stress test is that adequate oxygen is required for fetal activity and heart rate to be within normal ranges. When oxygen levels are low, the fetus does not respond normally. The goal is to prevent fetal death. The present study was conducted to evaluate the role of NST in improving the perinatal outcome in pregnancies complicated by preeclampsia.

Material and Methods

The patients were divided into two groups of 100 each. Group I (cases) – 100 patients of preeclampsia in whom NST was done. Group II (controls) – retrospective analysis of medical records of 100 patients of preeclampsia in the past one year where NST was not done. Pregnancies with eclampsia, premature rupture of membranes, multiple pregnancy, intrauterine death, fetal malformation, history of antepartum haemorrhage and medical disorders were excluded from the study. The procedure was thoroughly explained and informed written consent was taken from the patients fulfilling the inclusion criteria. After detailed history, a thorough general physical, systemic and obstetric examination was carried out. Patients were subjected to routine investigations like hemoglobin, blood grouping, glucose challenge test, urine albumin, thyroid profile, HIV, HBsAg. Sonography was done whenever required. Special investigations like liver function tests and renal function tests and fundus examination was carried out. Data was collected in a pre-structured proforma. After examination, the patient was subjected to weekly NST until the patient landed up in spontaneous or induced labour. During examination, the patient was kept at left lateral or semi-recumbent position. Recording was carried out over a period of 20 minutes at first. If nonstress test remained non-reactive or equivocal, external stimulus was given or vibro-acoustic stimulation using tuning fork and repeat NST was performed over 20 minutes. In case the NST remained non reactive or equivocal after the above said procedures, Biophysical scoring (BPP) using prenatal sonography was done. Controls consisted of 100 patients of preeclampsia in past one year. Retrospective analysis of medical records of these patients was done to assess the maternal and perinatal outcome and

comparison of these parameters was done in both the groups. Maternal outcome was assessed as mode of delivery, and indication of LSCS. Perinatal outcome was assessed as birth weight, Apgar score at 1 min and 5 minutes, need for NICU admissions and perinatal deaths.

Statistical analysis

At the end of the study, data was collected and analysed by using Student t-test for quantitative data and chi square test for qualitative data using SPSS version 17. p value of <0.05 was considered as significant.

Results

Table 1: Demographic profile

	Group I (n=100)	Group II (n=100)
Age	24.63±3.63	24.53±3.74
Education upto 10th	61(61%)	60(60%)
Unbooked	62%	65%
Para one(P1)	59%	55%
Lower socioeconomic status	45%	49%

Table 1 shows the demographic profile in majority of cases (group I) and control groups (group II). There was no statistical significance in both the groups. Majority of women i.e. 76% in group I & 73% in group II had mild hypertension. Only 24 women in group I and 27 women in group II had severe hypertension. Fourteen women in group I & 17 women in group II received prophylactic magnesium sulphate regime & this was found to be statistically insignificant.

Table 2: Period of gestation at admission and at delivery

POG (weeks)	Group I		Group II		Statistical significance
	Admission	Delivery	Admission	Delivery	
32-34+6	9	6	12	7	p>0.05
35-36+6	17	8	17	11	
37-38+6	40	52	38	49	
39-40+6	23	23	20	20	
>41 weeks	11	11	13	13	

Table 2 shows period of gestation at the time of admission and at delivery. It is evident from table 2 that 26% of women in group I & 29% women in group II were admitted before 37 weeks and only 14% women in group I and 18 women in group

II delivered before 37 weeks. This means that due to proper antenatal surveillance, we were able to prolong the period of gestation and thus preventing prematurity.

Table 3: Outcome of women at preterm gestation (<37 weeks)

	POG (weeks)	Spontaneous	Induced	Followed till term
Gp I	32-34+6 (n=9)	3	3	3 Spont=2 Induced =1
	35-36+6 (n=17)	5	3	9 Spont=4, Induced =5
Gp II	32-34+6 (n=12)	4	3	5 Spont=3 Induced =2
	35-36+6 (n=17)	5	6	6 Spont=2 Induced =4

As evident in table 3, in group I, nine women were admitted at 32-34+⁶ weeks, out of which three women passed into spontaneous labour and 3 women were induced after steroids. Rest 3 women were followed till term and non- stress test was

performed weekly. Seventeen women were admitted at 35-36+⁶ weeks, out of which 5 passed into spontaneous labour and 3 women were induced. Nine women were followed till term. Similarly in group II, eleven women were followed till term.

Table 4: Mode of delivery

Group I			Group II		
	Vaginal delivery (n=55)	Cesarean section (n=45)		Vaginal delivery (n=65)	Cesarean section (n=35)
Induced n=29	17 (30.90%)	12 (26.66%)	Induced n=27	18 (27.69%)	9 (25.71%)
Spont n=64	38 (69.09%)	26 (57.77%)	Spont n=69	47 (72.30%)	21 (60%)
Direct cesarean section	0	7 (15.55%)	Direct cesarean section	0	5 (14.28%)

Table 4 shows the mode of delivery in both the groups. Fetal distress was found to be the most common indication for LSCS in both the groups, in induced as well as spontaneous labour group. Direct LSCS were 7 in group I and 5 in group II.

Table 5: Perinatal outcome

	Group I	Group II	Statistical sig
Birth weight			
1) Normal BW-	79	71	p>0.05
2) Low BW	21	29	
Apgar			
1) <7 at 1 and 5 mins-	12	22	p<0.05
2) >7 at 1 and 5 mins-	86	74	
Neonatal complication			
1) Birth asphyxia+MAS-	10	20	p<0.05
2) Hypoglycemia-	1	2	p>0.05
3) Jaundice	3	5	p>0.05
4) Mortality	2	4	p>0.05
Admission			
1) Low BW-	12	14	p>0.05
2) Birth asphyxia+MAS-	10	20	p<0.05
3) Hypoglycemia-	1	2	p>0.05
4) Jaundice	3	5	p>0.05

Table 5 shows perinatal outcome in both the groups. It is evident that group I had better Apgar score and found to be statistically significant ($p<0.05$). Similarly, birth asphyxia & meconium aspiration syndrome (MAS) occurred in 10 newborns of group I and 20 newborns of group II and the comparison was found to be statistically significant. NICU admissions were 26 in group I and 41 in group II and was found to be statistically significant. It

is observed that out of 100 women in group I who were subjected to non-stress tests, sixty eight women were found to have reactive NST while 32(32%) women had non-reactive NST and these women were subjected to biophysical profile (BPP). Out of 32 non reactive NST, 26 women were found to have normal BPP while 6 had abnormal BPP.

Table 6: Outcome in NST group (n=100)

	Reactive n=68				Non-reactive n=32				Statistical significance
	Vaginal (n=46)	%	LSCS (n=22)	%	Vaginal (n=9)	%	LSCS (n=23)	%	
Total		67.64%		32.35%		28.125%		71.87%	p<0.05 Sig
Neonatal outcome									
Normal birth weight	42	91.30%	18	81.81%	7	77.77%	12	52.17%	p<0.05 Sig
Low birth weight	4	8.69%	4	18.18%	2	22.22%	11	47.82%	
Apgar score									
< 7/10	2	4.34%	2	9.09%	5	55.55%	3	13.04%	p<0.05 Sig
> 7/10	44	95.65%	20	90.90%	3	33.33%	19	82.60%	
NICU admissions: LBW									
Asphyxia + MAS	2	4.3%	1	4.54%	5	55.55%	2	8.69%	p<0.05 Sig p<0.05 Sig p>0.05 NS
Hypoglycemia	0	0%	1	4.54%	0	0%	0	0%	
Neonatal jaundice	0	0%	1	4.54%	1	11.11%	1	4.34%	
Mortality	0	0%	0	0%	1	11.11%	1	4.34%	

Table 6 depicts the outcome in NST group.

Table 7: Sensitivity/specificity/positive predictive value/ negative predictive Value NST-apgar/NST-Birth asphyxia/ NST- NICU admissions.

	NST-apgar	NST-birth asphyxia	NST-NICU admissions
Sensitivity	66.67%	70.00%	65.38%
Specificity	74.42%	72.62%	81.16%
Positive predictive value	26.67%	23.33%	56.67%
Negative predictive value	94.12%	95.31%	86.15%

Table 7 depicts the sensitivity, specificity, positive predictive value and negative predictive value of NST in relation to Apgar score, Birth asphyxia and NICU admission. It is evident that NST has a better specificity than its sensitivity and negative

predictive value of NST is more than positive predictive value. NST has better specificity than its sensitivity which means healthy fetus having reactive NST. Sensitivity is lower than specificity because in healthy fetuses NST can be non reactive like in sleep state, certain maternal drug abuse. The negative predictive value of NST is more than positive predictive value which means if NST is reactive, it is highly reassuring that the fetus is healthy with fetal deaths occurring within a week of normal NST being rare. Its positive predictive is low because NST can be non reactive even when the fetus is healthy e.g. in sleep states, certain maternal drug abuse.

Discussion

Age

Himabindu *et al.* found out that majority (38%) of women in their study population belonged to age group of 21-25 years, which is consistent with our study [1]. In the study on preeclamptic women by Adokiye *et al.* majority of patients (50.53%) were in the age group of 20-29 years [2]. This is clearly explained by the fact that preeclampsia is a disease of younger age group.

Education Status

In the study conducted by Saxena *et al.* forty percent women were illiterate and 37 % women had an education level below 10th standard [3]. Jwa *et al.* in their study concluded that lower educational group had significantly higher systolic BP than high educational group [4]. Silva *et al.* reported that the low educational group had significantly high blood pressure throughout pregnancy [5]. It can be attributed to the fact that women with higher level of education have the ability to obtain, process and understand the health information such as ANC, birth spacing, signs of complications and nutrition during pregnancy.

Booked/Unbooked

In the study by Khaskelil *et al.* majority (51.4%) of preeclamptic women were admitted at 35-38 weeks of gestation which is consistent with the present study [6].

Gestation at delivery

In the present study, in group I, fourteen women had delivered before term out of 26 women who were admitted before term & 86 women delivered at term. In group II, eighteen patients had delivered before term out of 29 patients who were admitted before term and the rest 72 women delivered at term. Thus prematurity was prevented due to adequate maternal surveillance due to the utilisation of NST in group I. In the study by Xiong *et al.* on preeclamptic women, the incidence of preterm delivery was 9% while 91% had delivery at term [7]. Theresia *et al.* in their study concluded that preeclampsia increases the risk of preterm delivery by 7 folds in preeclampsia as compared to normotensive women [8]. This is because hypertension decreases the uteroplacental blood flow which leads to intrauterine growth restriction and that causes preterm delivery.

Mode of Delivery

In the study by Khaskheli *et al.* it was observed that that 20% of preeclamptic women had undergone induction out of which 64.49% women had normal vaginal delivery and 28.3% women had LSCS. Failed induction occurred in 30.76% women [6].

Haverkemp *et al.* and Renou *et al.* in their study found statistically significant increase in caesarean rate in NST vs. no NST groups, i.e. (16.5% vs. 6.8%, 22.35% vs. 13.7%, respectively) [9, 10]. Induction of labour is favoured in preeclampsia as it is a critical intervention to prevent morbidity and mortality in both mother and fetuses.

Indication of Caesarean section

In our study, in both the groups, the most common cause of caesarean section was fetal distress in induced groups as well as in women who were left for spontaneous labour. It was followed by failed induction and non progress of labour. In the groups with direct caesarean section, the causes were mainly due to impending eclampsia with poor bishop and preeclampsia with abnormal Doppler. In the study by Geidam *et al.*, it was observed that maternal indication constituted 76.1% while fetal indications were 23.9% which included fetal distress (40.6%) followed by breech (19.66%), fetal macrosomia and pregnancy complicated by multiple fetuses [11].

Perinatal outcome

In the study conducted by Bano *et al.* The Apgar score < 7 at 5 minutes was 3.4% in the reactive NST group whereas 42.8% in the non reactive group. Around 3.6% of babies with reactive NST required NICU admissions whereas 28.5% of babies with non reactive NST required NICU admissions. They concluded that non reactive NST is significantly related to poor Apgar score and reactive NST to good Apgar score ($p < 0.001$) [12]. Bagum *et al.* (2002) reported 53 high risk pregnant women between January 1997 and May 1998 who were monitored by NST. They observed that reactive group showed favourable fetal outcome and non-reactive showed significant increase in overall abnormal outcome, low 1 and 5 minute apgar score, small for gestational age infants and subsequent admission into neonatal care unit and perinatal mortality. They concluded that NST is a valuable tool for the assessment of fetal well being in high risk pregnancies [13].

NST

In Group I, 68 women had reactive NST as against 32 women in which NST was nonreactive. In the study conducted by Shah *et al.* there were 71.7% cases of reactive NST and 28.3% had non reactive NST [14]. Fifty five (55%) women had reactive NST, 25% women had equivocal and 25% had abnormal NST in a study conducted by Garrison *et al.* [15].

Outcome

Gupta *et al.* in their study found out that 79.5% women in reactive NST had vaginal delivery, while in non-reactive NST group 7.6% women had vaginal delivery against 82.4% who had cesarean section which is comparable to our study [16]. In a study conducted by Deshpande *et al.* rates of vaginal delivery were found to be 35.7% in reactive group as compared to 26.6% in non-reactive group [17].

In a study conducted by Bano *et al.* 42.8% neonates had Apgar score < 7 at 5 minute in nonreactive while no neonate had low Apgar in reactive group [12].

Panda *et al.* in their study found out in their study that 9.30% infants had NICU admission in reactive group and 24.12% infants had NICU admission in non-reactive group which is quite comparable to our study [18].

Table 8: The sensitivity specificity PPV NPV

Authors		Sensitivity	Specificity	PPV	NPV
Himabindu <i>et al.</i> [11].	Birth asphyxia	84.29%	84.78%	53.33%	96.30%
	Apgar score	82.35%	82.72%	46.67%	95.51%
	NICU admission	92.31%	79.34%	40%	98.27%
Bano <i>et al.</i> [12].	Birth asphyxia	33.3%	90.9%	50%	90.9%
	Apgar score	75%	90.6%	25%	98.8%
	NICU admission	23.5%	90.3%	33.3%	85.2%
Agrawal <i>et al.</i> [19].	Birth asphyxia	78.9%	65.1%	28.8%	94.5%
	Apgar score	78.8%	71.7%	50%	90.4%
	NICU admission	100%	60.8%	9.6%	100%
Patel <i>et al.</i> [20].	Birth asphyxia	32.33%	92.22%	50.0%	85.29%
	Apgar score	35.82%	96.46%	70.58%	86.39%
	NICU admission	22.38%	97.87%	71.42%	84.14%
Present study	Birth asphyxia	70%	72.62%	23.33%	95.31%
	Apgar score	66.67%	74.42%	26.67%	94.12%
	NICU admission	65.38%	81.16%	56.67%	86.15%

Table 8 compares sensitivity, specificity, positive predictive value and negative predictive value of NST with birth asphyxia, Apgar score and NICU admission in present study with various studies.

Conclusion

The major goal of antepartum fetal surveillance is an appropriate & timely identification of fetuses at risk of morbidity and mortality & thus unnecessary delay in interventions can be avoided and hence a better perinatal outcome could be achieved. The results of the study suggests that NST is a simple, reliable, non invasive, cost effective procedure as a primary screening procedure in antenatal fetal heart rate monitoring and with its high specificity and negative predictive value, can be used as the single best admission test or screening test, especially in a resource sparse setting as it is a good predictor of a healthy fetus. Since present study reveals significant differences between two groups in terms of delivery type, Apgar score, NICU admissions and neonatal complications, this study suggest that NST as a valuable screening technique to be used routinely as diagnostic test especially in high risk pregnancies. As it is associated with high caesarean rates and also often misinterpreted and a non reactive test does not always indicate a compromised fetus, protocols using adjunctive testes (BPP, colour Doppler), prior to obstetric intervention helps to further improve the obstetric outcome.

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