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Evaluation of the role of Non-stress test in perinatal outcome of high risk pregnancy and its comparison with normal pregnancy: a prospective study

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ABSTRACT: Aim /objective: To improve perinatal outcome, there are a number of clinical and biophysical methods. The aim of this study is to analyse the role of Non-stress test in evaluating the perinatal outcome in high risk pregnancy and compare it with normal pregnancy.

Materials and methods: This was a multi-centre prospective descriptive observational study conducted in department of Obstetrics and Gynaecology, Tirath Ram Shah Hospital, New Delhi and Maharani Lakshmi Bai Medical College, Jhansi from January 2017 to December 2019. Two hundred cases were divided into two different groups - high risk and low risk and studied. Association between categorical variables was calculated by Chi- square test. The level of significance was set at $P<0.05$.

Results: There were 100 patients in each group. Almost half of the patients with high risk factors had a non reactive test (49%) and another half (51%) had a reactive trace ($p = 0.241$). Among the low risk group, the Sensitivity of NST for predicting Poor perinatal outcome was 87.5% as compared to 91.4% in the high risk group.

Conclusion: Non-stress test predicts the perinatal outcome in both high risk and low risk groups; therefore, Non-stress test is a good, economical, non-invasive, readily available screening test to predict fetal well being.

Key words: Non-stress test; high risk pregnancy; perinatal fetal outcome.

I. INTRODUCTION

The motto of world health organization is a healthy mother and child [1]. The modern obstetrics practice aims at fulfilling this motto by reducing maternal and fetal hazards during pregnancy. In India obstetricians are constantly and continuously working and thus have been able to considerably reduce maternal mortality but perinatal mortality is still high.

According to WHO, the perinatal mortality rate in the developing nations is 50/1000 live births as compared to 10/1000 in developed countries. In India it was 23/1000 live birth in 2016 [2,3]. Fetus is like a second patient having high risk of morbidity and mortality. Early detection of fetal risk during intrauterine life from uteroplacental insufficiency due to high risk factors, placental disease and disorder or fetal

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condition has gain more attention for perinatal medicine [4]. So, antenatal assessment of fetal wellbeing should be an integral part of management of pregnancy especially high risk pregnancy.

For fetal surveillance various clinical and biophysical methods are in use. These methods are complementary to each other. Various biophysical methods are Non- stress test (NST), biophysical profile, vibroacoustic stimulation, and biochemical methods were fetal scalp blood pH. Most of these method have been studied extensively and NST appears to be a powerful screening test [4,5]. NST is based on the observation that occurrence of accelerations of the fetal heart rate (FHS) in response to fetal movements is a reliable indicator of immediate fetal health.

Routine electronic monitoring should be done in high risk women, but normal pregnancies too require some reliable objective assessment to optimise the outcome as labour puts every foetus at the risk of intrapartum hypoxia.

The aim of this study is to analyse the role of NST in evaluating the perinatal outcome in high risk pregnancy and compare it with normal pregnancy.

II. MATERIALS AND METHODS

Study design

This was a multicenter prospective observational study conducted in department of Obstetrics and Gynaecology, Tirath Ram Shah Hospital, New Delhi and Maharani Lakshmi Bai Medical College, Jhansi from January 2017 to December 2019. One hundred high risk pregnant females who came to hospital for antenatal check up were included in the study. The protocol was approved by the institution's ethics committee. According to the principles of the declaration of Helsinki 1975, written, informed consent was obtained from all participants.

Patient

Patients were selected from those attending out-patient department and labour room/emergency of the institute. The age of patients ranged from 19 to 35 years with maximum patient falling within the age range of 21-24 years. Inclusion criteria for high risk singleton pregnancy were above 32 weeks gestation, pregnancy induced hypertension, gestational diabetes mellitus, pregnancy with anaemia, cholestasis of pregnancy, oligohyramnios / polyhydramnios, postdation, decreased or loss of foetal movements, intrauterine growth retardation/ small for date, unexplained foetal loss in previous pregnancy, pregnancy with medical disorders such as heart disease, renal disease, other chronic infection and normal singleton pregnancy above 34 weeks of gestation. While exclusion criteria were gestational age less than 32 weeks, multiple pregnancy, malpresentation, patient with previous caesarean section (CS), contracted pelvis or cephalopelvic disproportion, placenta previa and major congenital anomaly of the foetus on routine ultrasound.

Methods

The patients were selected randomly, irrespective of socioeconomic status, nature of pathology, height of patient. It was found that at 28 weeks of gestation, only 65% of healthy foetuses have a reactive NST. This percentage increases to 85% at 32 weeks and 95 % at 34 weeks. But in high risk pregnancy, the risk of antepartum foetal death, surveillance is generally recommended from earlier i.e. 32 weeks of gestation. So, in our study 100 high risk pregnant women above 32 weeks of gestation were taken for the study, and 100 normal pregnant women above 34 weeks of gestation were taken as a control group.

After obtaining complete informed consent, eligible subjects were evaluated, on the basis predesigned standard proforma which included patient information considering inclusion criteria i.e. history of patient, routine general physical and systemic examination. Following investigations were done: complete haemogram with ESR, liver function test (LFT) , routine examination of urine, urinary protein, blood grouping, renal function test (RFT), blood sugar, and ultrasonography (USG).

All the patients were counselled for the procedure. Patients were asked to take light meal before the study and also instructed to empty the bladder before NST. The patients were made to lie supine with 15-30 degree left lateral tilt to displace the uterus from the inferior vena cava minimise the aortocaval compression. After applying aqua sonic jelly, the US (foetal heart rate) transducer was fixed on the lower abdomen where foetal heart rate was most clearly audible. The toco transducer was belted on the upper abdomen at the level of uterine fundus to detect the anterior deflection of the uterus that occurs during the contraction. The patient was asked to held event marker and instructed to press the button with each foetal movement. Points

considered in reading a graph were baseline FHR, beat-to-beat variability, qualifying accelerations, any deceleration presence of foetal movements. The tracings were reviewed every 20 minutes. When the criteria of a reactive test were met, the test was considered as complete.

Test was considered reactive in presence of baseline FHR 110-160 bpm, variability 5-25 bpm, two or more accelerations that peak at 15 bpm or more, each lasting for 15 seconds or more, occurring within 20 minutes of the test, absence of deceleration and it was considered non-reactive while baseline variability was less than 5 bpm, baseline FHR <110 or >160, no qualifying acceleration, late deceleration or variable deceleration, sinusoidal pattern. In case of non-reactive features, the test was prolonged up to 40 minutes.

Following parameter were evaluated : NST Result and in maternal : mean NST delivery interval, mode of delivery, presence of intrapartum complications and in fetal APGAR score at 5 minutes, need for resuscitation after delivery, meconium staining of the liquor, admission to neonatal intensive care unit (NICU), perinatal mortality,

Statistical analysis

The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0. Categorical variables were presented in number and percentage while continuous variables were presented in mean and standard deviation. Association between categorical variables was calculated by Chi- square test. The level of significance was set at $P \leq 0.05$.

III. RESULTS

In the low risk group, the minimum age was 19 years and maximum age was 35 years and the high risk group, the minimum age was 20 years and maximum age was 35 years. The mean age for low risk and high risk groups were 26.59 years and 28.22 years respectively. There was statistical difference in the mean age between the two groups as p value = 0.001. Table 1 shows age wise distribution of patients. The mean age in high risk and low risk groups shown in table 2 and table 3 shows parity wise distribution of patients.

In the low risk group, 65% patients were primigravida and 35% were multigravida, whereas in high risk group, 43% were primigravida and 57% were multigravida. Multigravida were found more commonly in high risk group.

In the high risk group, mean duration of labour was 32.3 hours and 30.2 hours in a reactive and non reactive trace respectively (p=0.565). In the low risk group, mean duration of labour was 37.6 and 32.2 hours in a reactive and non reactive trace respectively (p=0.496). Overall, the duration of labour was 35.4 hours with a reactive trace and 31 hours with a non reactive trace. (p=0.09)

The mean duration of labour in low risk group was 36.03 hours whereas in high risk group was 31.33 hours. ($p > 0.05$). The results were statistically not significant.

The patients in low risk and high risk groups were followed up for mode of delivery. In low risk group, 67% had a vaginal delivery, 3 had a forceps delivery and 27% of the patients underwent lower segment caesarean section (LSCS) but in high risk group, the LSCS rate was as high as 55%, normal delivery 44% and forceps delivery 1%. The difference was statistically significant $P<0.05$.

Almost half of the patients with high risk factors had a non reactive test (49%) and another half (51%) had a reactive trace ($p = 0.241$). Table 4 shows various intranatal and postnatal factors in NST reactive and non-reactive groups.

The sensitivity, specificity, negative and positive predictive value in high risk and low risk groups are shown in table 5. Among the low risk group, the Sensitivity of NST for predicting Poor perinatal outcome was 87.5% as compared to 91.4% in the high risk group. Negative predictive value (NPV) of NST was almost similar in both the groups, 95.7% in the low risk patients and 94.1% in the high risk group. The Specificity and Positive predictive value (PPV) was 88.1% and 70% respectively in the low risk group and 73.8% and 65.3% respectively in the high risk group.

IV. DISCUSSION

There has been a drastic change in the management of patient in labour. Efforts to identify high risk factors and to prevent intrapartum complications have improved significantly to prevent foetal distress. The prompt and effective management have become an integral part of Intrapartum care.

Electronic foetal monitoring is an important tool for early detection of hypoxia; thus avoiding unnecessary delay in intervention. It is

a non-invasive and highly logical recordable method of foetal monitoring in comparison to the undeniable human lapses of manual foetal monitoring in labour [6,7].

This evaluation is important in routine obstetric population as well because the Intrapartum morbidity develops in up to 10-20% of patients who are considered to be at low risk [8]. Therefore, this prospective study was undertaken to compare the NST in high risk and low risk pregnancy.

Among the various antenatal surveillance modalities available to detect and manage high risk pregnancies such as NST, contraction stress test (CST), Biophysical profile (BPP), modified BPP, Doppler velocimetry, NST is one of the easiest and cost effective method [6,7]. There are studies that support the use of NST in the management of high risk pregnancies [6,7].

In 1986, Ingemarsson et al published first study assessing the ability of NST to predict foetal distress [6]. Since then many studies have been conducted to access the role of NST to predict perinatal outcome [9,10].

In the present study, the mean age of patients in both the groups is almost similar. The complication rate is increases as the age advances. Parity also has the similar effect. This is why in high risk group , multigravida were more in number than in primigravida

In this study, the high risk patients (58%) included postdated (21%), pregnancy induced hypertension (PIH) (19%) or oligohydramnios with intrauterine growth retardation (IUGR) (18%). The results were comparable to a study done by Goyal et al [11] where they observed PIH , postdatism and oligohydramnios as the most commonly occurring risk factors (60%).

In this study, 51% of the high risk and 70% of the low risk patients had a reactive NST. However, 49% of high risk pregnancies had a non – reactive test as compared to 30% in the low risk group which was statistically significant (p=0.000). The percentage of non-reactive tests in our study is almost similar to other studies [12,13].

In a study, the incidence of foetal distress was 100% with a non reactive NST result [14]. In the present study also, there were increased intranatal complications such as intrapartum fetal distress (IPFD), meconium stained liquor (MSL), Prolonged 2nd Stage of Labour and non progress of labour (NPOL) in both high risk (100%) and low risk(97%) pregnancies when the trace was non reactive. Overall, the incidence of these complications was also more in the high risk group (65%) as compared to low risk patients (35%). Elimian et al concluded that women with a non reactive NST were more likely to have foetal distress resulting in LSCS and to have longer neonatal hospital stay[15].

The Apgar scoring system is as an evaluative measure of a newborn's condition at birth and of the need for immediate attention[16]. In a study by Lohana et al [17], the incidence of low Apgar Score was 3.53% in the reactive group and 40% in the non reactive group. In our study, the low risk patients had an incidence of Low Apgar Score 1.4% in the reactive group and 40% in the non reactive group. The results are comparable to our study. Therefore, when the trace was non reactive, the rate of low Apgar score was significantly higher.

There was increased low birth babies in the patients with a non reactive test (22.7%) as compared to patients with a reactive test (9.9%). The difference is probably due to increased non reactive test results in the high risk patients such as IUGR, Oligohydramnios. The results were comparable to a study done by Sharbaf et al [18] who observed increased incidence of low birth babies in patients with non reactive NST. Similar results were obtained with our study wherein, there was an increased requirement of assisted ventilation such as Bag & Mask and Endotracheal Intubation in the babies when the mother's NST was Non Reactive (58.2%) as compared to 6.6% with a reactive NST. The difference was statistically significant in both the groups.

In our study also, poor perinatal outcome with respect to MSL, Low Apgar Score and NICU admission was studied and it was found to be 65.3% and 70% in high risk and low risk pregnancy respectively when the trace was Non Reactive. Rayburn et al (1980) studied 561 high risk patients and found increased rate of adverse perinatal outcome in patients with a non reactive trace (36%) as compared to 4% in patients with a reactive trace [20]. Shah et al in their study found almost 50% asphyxiated babies with a poor perinatal outcome when the NST was non reactive as compared to only 1.3% when the test was reactive [21].

In a study by Panda et al [19], they evaluated

100 normal pregnant patients and found 78.5% patients with a non reactive test had a poor perinatal outcome. Our results were comparable with previously published studies.

In our study, out of 100 high risk cases, there was only one perinatal death in the non-reactive test group and no perinatal death in the low risk group. The Sensitivity and NPV of the test was 100%. .The specificity was 51.5%. PPV was very low, 2%. This shows that a reactive test is an excellent indicator of a healthy fetus.

Perinatal outcome with respect to MSL, Low Apgar Score and NICU admission were studied. The sensitivity of NST to predict poor perinatal outcome was 87.5% in the low risk and 91.4% in the high risk category respectively. The results were comparable to Sultana et al (87%) [22] and Shah et al (93.3%) [21].

It can be concluded that NST test predicts the perinatal outcome in both high risk and low risk groups; therefore, NST is a good, economical, non-invasive, readily available screening test to predict fetal well being.

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Tables 1-5

Age (Years)	Low Risk Group No.	High Risk Group No.
18-20	5	1
21-25	34	26
26-30	45	45
31-35	16	28

Table 1: age wise distribution

RISK FACTORS	NO. OF PATIENTS	% OF PATIENTS
PIH	19	19%
GDM	12	12%
Anaemia	7	7%
IHCP	4	4%
Oligohydramnios/IUGR	18	18%
Postdated	21	21%
Decreased FM	7	7%
BOH	10	10%
Pregnancy with Medical disease	2	2%

Table 2: Distribution of high risk pregnancy according to clinical high risk factors; PIH: pregnancy induced hypertension , GDM: gestational diabetic mellitus , IHCP: intrahepatic cholestasis of pregnancy , IUGR: intrauterine growth retardation, FM: foetal movement , BOH: bad obstetric history

Risk Factors	Reactive	Non Reactive
PIH	9	10
GDM	6	6
Anaemia	6	1
IHCP	2	2
Oligohydramnios with IUGR	7	11
Postdated	8	13
Decreased FM	4	3
BOH	7	3

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Medical Disease	2	0

Table 3: distribution of high risk patients according to NST result; PIH: pregnancy induced hypertension ,GDM: gestational diabetic mellitus , IHCP: intrahepatic cholestasis of pregnancy , IUGR: intrauterine growth retardation, FM: foetal movement , BOH: bad obstetric history

Parameters	LR reactive	LR non-reactive	HR reactive	HR non-reactive
Mode of delivery				
Vaginal	67	4	40	4
Forceps	03	0	1	0
LSCS	0	26	10	45
Intranatal complications				
IPFD	1/70	12/30	2/51	22/49
NPOL	0/70	07/30	10/51	14/49
Prolonged 2nd stage	3/70	0/30	03/51	0/49
MSL	2/70	10/30	01/51	13/49
APGAR score				
<7	1	12	01	17
>7	69	18	50	32
Birth weight				
<2.5 Kg	9	5	3	13
>2.5 Kg	61	25	48	36
Respiration mode				
Spontaneous	65	8	48	25
Bag and mask	5	17	3	17
Endotracheal intubation	0	5	0	7
NICU requirement				
No	70	14	49	26
Yes	0	16	2	23
Perinatal outcome				
Poor	3	21	3	32
Good	67	9	48	17
Perinatal mortality	0	0	0	1

Table 4: Distribution of various intranatal and postnatal parameters according to NST results; LSCS: lower segment caesarean section , IPFD: intrapartum fetal distress, NPOL : non progress of labour , MSL : meconium stained liquor, NICU : neonatal intensive care unit.

	Parameters	SENSITIVITY	SPECIFICITY	PPV	NPV
Low risk group	IPFD	92.3%	79.3%	40%	98.5%
	LOW APGAR SCORE	92.3%	79.3%	40%	98.5%
	MSL	83.3%	77.2%	33.3%	97.1%
	NICU ADMISSION	100%	83.3%	53.3%	100%
High risk group	IPFD	91.6%	64.4%	44.8%	96%
	LOW APGAR SCORE	94.4%	60.9%	34.7%	98%
	MSL	92.8%	58.1%	26.5%	98%
	NICU	92%	65.3%	46.9%	96%

	ADMISSION				
	PERINATAL MORTALITY	100%	51.5%	2%	100%

Table 5: Accuracy for NST for intrapartum foetal distress, MSL, low APGAR, NICU admission and perinatal mortality in high risk and low risk pregnancy; IPFD: intrapartum fetal distress, MSL : meconium stained liquor, NICU : neonatal intensive care unit, PPV: Positive predictive value. NPV: Negative predictive value.