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Role of Non-Stress Test and Doppler in Assessment of Perinatal Outcome in High-Risk Pregnancy

Medical Science

KEYWORDS : Fetal Doppler, non-stress test, High risk pregnancy.

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ABSTRACT

Background: Primary purpose of foetal surveillance is to detect foetal hypoxia and acidosis which are common causes of foetal and perinatal mortality. Significant Doppler changes occur with reduction in foetal growth at a time when other foetal tests are still normal.

Material & methods: During the study, 100 women with high risk pregnancy were selected and a prospective randomised study was carried out. NST was done in every patient and repeat NST was done according to high risk factors present. USG for foetal assessment, liquor adequacy, and Doppler analysis of foetal arteries was carried out by Duplex scanner.

Results: Most common high risk factor in present study is PIH (60%) followed by post-dated pregnancy (21%). 23% women had abnormal Doppler and 45% had non-reactive NST. 49% patients showed both foetal surveillance tests normal and 21% showed both abnormal.

Introduction Ante partum foetal surveillance of high risk pregnancies like Pregnancy Induced Hypertension, Diabetes Mellitus, Oligohydramnios, Rh incompatibilities to obtain a fruitful outcome has been a biggest challenge to obstetricians.

Primary purpose of foetal surveillance is to detect foetal hypoxia and acidosis which are the common causes of foetal death and to possibly avoid perinatal morbidity and mortality.

In recent years there has been explosion of new developments with use of foetal monitoring by contraction stress test, Non stress test, Biophysical profile, Vibroacoustic stimulation test and recently computerized foetal heart rate and biophysical assessment is ideal for high risk foetuses.

Doppler study is one of the most recent and non-invasive diagnostic modality for obstetricians. Abnormal Doppler findings are associated with foetal growth restriction and have been used as a screening test for foetal stress. Absent or reversed diastolic flow is a particularly ominous finding indicating extreme downstream resistance, placental dysfunction and foetal compromise.1

Significant Doppler changes occur with reduction in foetal growth at a time when other foetal wellbeing tests are still normal2. Doppler identifies a prodrome of foetal disease when the decline in biophysical variables is subtle.3

With the combined use of USG and NST for foetal surveillance it is possible to detect both acute and chronic insults of foetus and to provide appropriate management for positive outcome2.

Materials and Methods

During the study period of 3 years 100 women with high risk factors were selected and a prospective randomised study was carried out.NST was done in every patient and repeat NST according to the high risk factor present.USG for foetal assessment, liquor adequacy, Doppler analysis of umbilical artery, middle cerebral artery was carried out by Duplex scanner.

S/D (Systolic/Diastolic) ratio, Resistance Index (RI) &Pulsatility Index (PI) in umbilical and middle cerebral artery were noted. All patients were observed for intrapartum signs of hypoxia and maternal and foetal outcome was noted.The perinatal outcome parameters studied were mode of delivery, gestational age at delivery, birth weight, perinatal mortality, neonatal morbidity in terms of 5 minute Apgar score <7, neonatal intensive care unit (NICU) stay and complications that developed.

Results were statistically analyzed by sensitivity, specificity, positive predictive value and negative predictive value.

Results

Mean age in present study is 23.5years, most of the patients were primi gravida (60%) & coming from low socio-economic class. Most common high risk factor in present study is PIH (60%) followed by postdate pregnancy (21%).

In this study, 23% women had abnormal Doppler and 45% had non-reactive NST. About 49% patients show both foetal surveillance tests normal and 21% show both abnormal so in 70% patients both tests complement each other.

Table (1) shows 38% patients with PIH had abnormal Doppler& that nearly 50% of women with PIH and Postdate pregnancy had non-reactive NST. Total 45% of patients had non-reactive NST

Table (2) shows that NST and Doppler are two distinct but still associated investigations for foetal surveillance. Table shows good correlation between the two investigations .70% cases results of these two correlate with each other.

Table (3) compares the results of reactive and nonreactive NST with prospects of vaginal delivery and those of delivering a healthy baby. When NST was reactive 85% women had vaginal delivery and foetal outcome was good in 90.9% women. Out of 45 women with non-reactive NST only 45% had vaginal birth and 21 babies (46%) required NICU admission.

Similarly when the Doppler was normal most women (89%) had vaginal delivery and fetal outcome was good in 94.5%. When Doppler was abnormal caesarean was done in 74% and most babies (81.5%) required NICU admission.

On combining both the tests, when both were normal vaginal birth was possible in 91.8% and foetus was healthy in 95.9%. With both tests being non-reassuring caesarean was done in 95.2% and NICU admission was required in 90.4% babies.

Table (4) shows that NST has low sensitivity but high specificity, while Doppler has both high sensitivity and specificity & when both tests are combined the predictive values are further improved.

Discussion

We have assessed foetal Doppler and NST in a group of women with high risk pregnancy comprising Pregnancy Induced Hypertension, Diabetes Mellitus, Oligohydramnios and post datism. It is evident that when both NST and Doppler are abnormal the baby weight and gestational age at birth are low while perinatal mortality and neonatal morbidity are high. Though both the tests were effective in predicting abnormal outcome, the significant advantage of Doppler over NST was that Doppler showed changes earlier than NST giving a significant lead time.2 This lead time is very important 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 foetus. Steroid prophylaxis can be administered during this period in preterm foetuses. The significant lower birth weight of foetuses when both Doppler and NST are abnormal indicates that these foetuses suffer from a more severe degree of placental insufficiency. When Doppler was abnormal caesarean was done in 74% in our study which corresponds to 76% in study by Deshmukh et al.4 Most babies (81.5%) required NICU admission when Doppler was abnormal. In study by Chauhan et al, 90% patients with abnormal Doppler finding had adverse perinatal outcome.5

When neonatal survival prospects are good it is better to deliver the compromised foetus than to monitor till the development of abnormal NST. These babies were less compromised and were relatively more advanced in gestation so early intervention was possible. The Growth Restriction Intervention Trial (GRIT) 6, which was designed to time delivery in compromised preterm foetuses, showed that delaying delivery to increase maturity in severe hypoxemia increased stillbirths to nearly fivefold while deaths before discharge fell by one third.2 The hemodynamic changes picked up by Doppler occur in the compensatory phase of growth restriction. Fetal heart rate abnormalities occur much later in the decompensation phase, which is a late sign of foetal compromise.

Combined foetal testing modalities such as Doppler, NST and biophysical profile provide a wealth of information regarding foetal health. Integrated foetal testing would be ideal for individualised care of the preterm compromised foetus for timed intervention.

Disadvantages of Doppler are the requirement of sophisticated equipment and a degree of operator skill and expertise which may not be available in all centres. NST has the advantage of ease of use and interpretation, low cost and minimal time required. So it remains a mainstay in detection of a compromised foetus in many hospitals.

Recent meta analysis of randomised controlled trials suggest that incorporation of umbilical artery Doppler waveform analysis into management protocols for intrauterine growth restricted foetuses significantly decreased perinatal mortality.7

Conclusion

Doppler is useful for recognising foetal compromise earlier than NST giving a lead time which is vital in management of preterm high risk pregnancies. An abnormal Doppler when followed by an abnormal NST is associated with worst perinatal outcome. Thus if Doppler is abnormal and prospects of foetal survival are good it is better to deliver the foetus before NST becomes abnormal.NST has low sensitivity but in cases with normal Doppler sudden abnormal NST indicates acute hypoxia, NST has advantage of low cost and ease of application thereby making it important in surveillance. Thus both NST and Doppler are complimentary to each other in management of high risk pregnancies with the clinical scenario dictating the choice of appropriate test.

Table 1: Doppler & NST outcome in different High Risk Patients

High risk factor (N=100)	Doppler result		Non stress Test	
	Normal	Abnormal (%)	Reactive	Nonreactive (%)
PIH (60)	37	23(38.3)	32	28(46.6)
Post date (21)	18	3(14.28)	10	11(52.38)
Oligohydramnios (13)	12	1(7.69)	8	5(38.46)
Diabetes (3)	3	0(0)	2	1(33.3)
Placenta praevia (3)	3	0(0)	3	0(0)

Table 2: Comparison of NST & Doppler test

NST	Doppler Normal	Doppler abnormal	Chi-square result	
	reactive	49	6	X^2=6 Significant at 95% confidence interval
	nonreactive	24	21	

Table 3: Foetal and Maternal Outcome with Foetal Surveillance Tests

Foetal Surveillance test Vaginal (72)		Mode of Delivery		Foetal Outcome Baby	
		Caesarean (28)	Apgar >7(74)	Apgar<7(26) (NICU admission)	
Non-Stress Test	Reactive (55)	47	8	50	5
	Non-Reactive(45)	25	20	24	21
Doppler	Normal (73)	65	8	69	4
	Abnormal (27)	7	20	5	22
NST and Doppler	Both normal(49)	45	4	47	2
	Both abnormal(21)	1	20	2	19

Table 4: Outcome of Fetal surveillance

Test	Sensitivity	Specificity	PPV	NPV
Non-stress test	67.56%	80.76%	90.90%	46.66%
Doppler	93.24%	84.61%	94.52%	81.42%
Non-stress test and Doppler	95.91%	90.47%	95.91%	90.47%

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