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ORIGINAL ARTICLE

Comparative Study of Nonstress Test and Fetal Acoustic Stimulation Test in Assessment of Fetal Well-being

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ABSTRACT

Objectives: To compare and evaluate the role of nonstress test and acoustic stimulation test on the perinatal outcome.

Materials and methods: Around 100 patients above 34 weeks of gestation were selected and subjected to nonstress test (NST) and acoustic stimulation test (AST) on weekly basis to find whether fetus is reactive or nonreactive, and followed till delivery to find out the perinatal outcome.

Results: When comparison of reactive NST and reactive AST was done, the incidence of meconium staining was 8 (9%) and 9 (9.6%), clinical fetal distress 16 (18.8%) and 18 (19.3%), operative interference for fetal distress 17 (19.3%) and 20 (21.5%), low Apgar score at 5 minutes 1 (1.1%) and 1 (1%), neonatal deaths 3 (3.3%) and 3 (3.2%), low birth weight 27 (30.6%) and 29 (31.1%), and NICU admission 13 (14.7%) and 13 (13.9%) respectively. While the incidence of meconium staining was 4 (33.3%) and 3 (42.8%), clincal fetal distress 8 (66.6%) and 6 (85.7%), operative interference 6 (50%) and 3 (42.8%), low Apgar score at 5 minutes 3 (25%) and 3 (42.8%), neonatal death 4 (33.3%) and 4 (57.1%), low birth weight 7 (58.3%) and 5 (71.4%) respectively in nonreactive NST and nonreactive AST groups.

Keywords: Nonstress test, Acoustic stimulation test.

INTRODUCTION

Nonstress test is commonly used for antepartum evaluation of fetal well-being. The rationale underlying this test is the presence of spontaneous fetal heart rate acceleration associated with fetal movement, is an indicator of fetal well-being.[1] Nonstress test has high predictivity and low false-negative rate, but the main disadvantage with NST is that it has high frequency of false-positive results and interpretation of NST relies only on one variable, that is acceleration of fetal heart rate associated with movement. Often fetus is asleep at the time of testing, and considerable time is spent waiting for sufficient acceleration to occur to correctly interpret results. It is known that FHR changes, e.g. accelerations can be induced in the antenatal period by sound stimulation of fetus.[2,3] This acoustic stimulation test (AST) offers an advantage over NST by lowering both the incidence of nonreactive test and testing time, and could thus be used as a test of fetal assessment.

MATERIALS AND METHODS

Around 100 patients above 34 weeks of gestation were selected for the study and followed till delivery. NST and AST were done on weekly basis to find whether fetus is reactive or not. The equipment used for FHR recording was Hewlett Packard series 50 fetal monitor. After a detailed history and clinical examination, all patients were subjected to NST. Interpretation of NST was done according to American College of Obstetrics and Gynecology (1999). Acoustic stimulator by Teksonic instruments with sound pressure level of 80 to 85 dB was used for AST. The fetus was stimulated for less than 3 seconds. If no quantifying accelerations were noted, the stimulus was repeated at 1 minute interval for maximum three times, and recording was done for 5 minutes. Interpretation of AST was done.[6]

All patients were carefully followed during labor to find out the pregnancy outcome. Parameters like meconium staining of liquor, fetal distress during labor, mode of delivery, Apgar score, birth weight, perinatal morbidity and mortality were followed. Z and P test were used for statistical analysis of the significance of incidence rate of each measure of outcome. Patients were divided into four groups on the basis of NST and AST results:

- Group I—Patients with reactive NST and AST
- Group II—Patients with nonreactive NST but reactive AST
- Group III—Patients with reactive NST and nonreactive AST
- Group IV—Patients with nonreactive NST and AST

OBSERVATIONS

In the present study of 100 patients, NST was reactive in 88 patients (88%) and nonreactive in 12 patients (12%). AST was reactive in 93 patients (93%) and nonreactive in 7 patients (7%). Out of 12 nonreactive NST patients, 5 were found to be reactive by AST. Thus, there was reduction in the number of nonreactive NST from 12 to 7% nonreactive AST. This difference was statistically significant (p value < 0.05).

When comparison of reactive NST and AST was done (Table 1), the incidence of meconium staining was 8 (9%) and 9 (9.6%), clinical fetal distress 16 (18.8%) and 18 (19.3%), operative interference for fetal distress 17 (19.3%) and 20 (21.5%), low Apgar score at 5 minutes 1 (1.1%) and 1 (1%), neonatal deaths 3 (3.3%) and 3 (3.2%), low birth weight 27 (30.6%) and 29 (31.1%), and NICU admission 13 (14.7%) and 13(13.9%) respectively. The incidence of meconium staining, low Apgar score at 5 minutes, clinical fetal distress (CFD), operative interference for fetal distress, neonatal death, low birth weight, and NICU admission were found to be statistically non significant in reactive NST and AST group.

When nonreactive NST was compared with AST (Table 1), the incidence of meconium 4 (33.3%) and 3 (42.8%), CFD 8 (66.6%) and 6 (85.7%), operative interference 6 (50%) and 3 (42.8%), low Apgar score at 5 minutes 3 (25%) and 3 (42.8%), neonatal death 4 (33.3%) and 4 (57.1%), low birth weight 7 (58.3%) and 5 (71.4%) respectively. There was significantly higher incidence of clinical fetal distress, operative interference for fetal distress, neonatal death and NICU admission in nonreactive AST group as compared to nonreactive NST group. There was no difference in the incidence of meconium staining, low Apgar score, low birth weight between two groups.

Table 2 shows that NST was slightly more sensitive than AST for predicting presence of meconium, clinical fetal distress, operative interference for fetal distress and admission to NICU. AST is more specific than NST for predicting meconium, clinical fetal distress, operative interference for fetal distress, low Apgar score, low birth weight, admission to NICU and neonatal death. The positive predictive value of AST is more than NST for clinical fetal distress, operative interference for fetal distress, low Apgar score, low birth weight and neonatal death but NST has more positive predictive value for meconium and admission to NICU. Both NST and AST have similar negative predictive value for seven parameters of pregnancy outcome.

The occurrence of meconium, CFD and operative interference for fetal distress were found to be more in group II as compared to group I and it was statistically significant (Table 3).

As shown in Table 4, there were increased incidence of all parameters of pregnancy outcome in group IV compared to group I and the results were statistically significant.

There was high incidence of all seven parameters in group IV when compared with group II, but the incidence of meconium staining, clinical fetal distress, low Apgar score and death due to asphyxia were statistically significant (Table 5).

Table 1 Comparison of NST and AST

Pregnancy outcome	*Reactive NST n = 88*	*Reactive AST n = 93*	*p-value*	*Nonreactive NST (n = 12)*	*Nonreactive AST (n = 7)*	*p-value*
Meconium staining	8	9	NS	4	3	NS
Clinical fetal distress	16	18	NS	8	6	< 0.05
Operative interference	17	20	NS	6	3	< 0.05
Low Apgar score (5 minutes)	1	1	NS	3	3	NS
Low birth weight (< 2.5 Kg)	27	29	NS	7	5	NS
NICU admission	13	13	NS	4	4	< 0.05

NS: Non significant

Table 2 Comparison of sensitivity, specificity, positive and negative predictive value of NST and AST

Pregnancy outcome	*Sensitivity*		*Specificity*		*Positive predictive value*		*Negative predictive value*	
	NST	*AST*	*NST*	*AST*	*NST*	*AST*	*NST*	*AST*
Meconium	33.3	25	90.9	95.4	50	42.8	90.9	90.3
Clinical fetal distress	33.3	25	94.7	98.6	66.6	85.7	81.8	80.6
Operative interference (FD)	26	13	92.2	94.8	50	75	80.6	78
Low Apgar score (5 minutes)	75	75	90.6	95.8	25	42.8	98.8	98.9
Low birth weight	20.5	17.5	92.4	96.9	58.3	71.4	69.3	68.8
Admission to NICU	23.5	13.3	90.3	94.1	33.3	28.5	85.2	86
Expiry	57.1	57.1	91.3	96.7	33.3	57.1	96.5	96.7

Table 3 Comparison between group I and group II

Pregnancy outcome	*Reactive AST Reactive NST (n = 88)*		*Reactive AST Nonreactive NST (n = 5)*		*p-value*
	Group I		*Group II*		
	No.	%	No.	%	
Meconium	8	9	1	20	< 0.05
Clinical fetal distress	16	18.8	2	40	< 0.05
Low Apgar score (5 minutes)	3	3.4	0	0	0
Operative interference (FD)	17	19.3	2	40	< 0.05
Low birth weight	28	31.8	2	40	NS
NICU admission	12	13.6	1	20	NS
Expiry	3	3.4	0	0	0

NS: Non significant

Table 4 Comparison between group I and group IV

Pregnancy outcome	*Reactive AST Reactive NST (n = 88)*		*Nonreactive AST Nonreactive NST (n = 7)*		*p-value*
	Group I		*Group IV*		
	No.	*%*	*No.*	*%*	
Meconium	8	9	3	42.8	< 0.05
Clinical fetal distress	16	18.8	6	85.7	< 0.05
Low Apgar score (5 minutes)	0	0	3	42.8	< 0.05
Operative interference (FD)	17	19.3	3	42.8	< 0.05
Low birth weight	28	31.8	4	57.1	< 0.05
NICU admission	12	13.6	2	28.5	< 0.05
Expiry	3	3.4	4	57.1	< 0.05

Table 5 Comparison between group II and group IV

Pregnancy outcome	*Reactive AST Nonreactive NST* (n = 5)		*Nonreactive AST Nonreactive NST* (n = 7)		*p-value*
	Group II		*Group IV*		
	No.	*%*	*No.*	*%*	
Meconium	1	20	3	42.8	< 0.05
Clinical fetal distress	2	40	6	85.7	< 0.05
Low Apgar score (5 minutes)	0	0	3	42.8	< 0.05
Operative interference (FD)	2	40	3	42.8	NS
Low birth weight	2	40	4	57.1	NS
NICU admission	1	20	2	28.5	NS
Expiry	0	0	4	57.1	< 0.05

NS: Non significant

DISCUSSION

In the present study of 100 patients, 12 were nonreactive on NST, when these 12 nonreactive NST patients were subjected to AST, five where found to be reactive to AST. Thus, there was reduction in the number of nonreactive NST from 12 to 7% nonreactive AST, and this difference was statistically significant (p-value < 0.05).[4] Observed a reduction in nonreactive NST from 14 to 9% nonreactive AST. Thus, the AST has the advantage over NST by lowering the incidence of nonreactive test and reducing false-positive results with NST.

When reactive NST and reactive AST were compared for seven parameters of pregnancy outcome, the difference in the incidence of meconium staining and low Apgar score at 5 minutes were found to be statistically significant, while the incidence of clinical fetal distress, operative interference for fetal distress, neonatal death, low birth weight and NICU admission showed nonstatistical significance.[5] In his study also found no significant difference when reactive NST and AST were compared for incidence of meconium, Apgar score and fetal distress.

When nonreactive NST and nonreactive AST were compared, there was significant difference in the incidence of clinical fetal distress, operative interference for fetal distress, neonatal death, and NICU admission. In our study, nonreactive AST has a better predictive value for fetal distress, neonatal death and NICU admission. There were no difference in incidence of meconium staining, low Apgar score, low birth weight between the two nonreactive AST and NST groups, which was in consistence with the study.[5] NST was slightly more sensitive than AST for predicting pregnancy outcome but AST more specific than NST.

In the present study, when the results of combined tests were compared with each other, there were progressive increase in the incidence of meconium, clinical fetal distress, low Apgar score, operative interference for fetal distress, low birth weight and admission to NICU in group II (reactive AST and nonreactive NST) and group IV (nonreactive NST and AST) as compared to group I (reactive NST and AST).

CONCLUSIONS

It is concluded from the present study that better prediction of perinatal outcome can be done by the combined use of NST and AST rather than using NST alone. When AST is used as an adjunct to NST, it helps in reducing false nonreactive NST and also reduces the length of testing time to elicit a reactive response. A reactive AST in a case of nonreactive NST reduces the need for more complicated test, such as Manning score and Doppler studies, etc. Only, when both NST and AST are nonreactive should the patient be subjected to further systems of testing.

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