

## ANTENATAL FETAL SURVEILLANCE BY ACOUSTIC STIMULATION TEST

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### SUMMARY

A prospective study was carried out to assess fetal wellbeing in antenatal period by Acoustic Stimulation test. The Acoustic stimulation test employs an external vibroacoustic stimulation of fetus by means of a transabdominally applied 5 C Electronic Artificial Larynx (EAL). The test was performed on 135 antenatal patients of high risk and low risk group. The result of the test is predictive of fetal outcome within one week of delivery, hence 167 ASTs, were performed. The result of AST was correlated with various parameters to assess fetal outcome. A reactive AST was seen in 94.1% of patients, while non-reactive AST was observed in 5.9% of the patients. Fetal heart rate deceleration during labor was observed in 9.4% of patients with reactive AST as compared to 50% with a non-reactive AST, the difference is statistically significant. It is seen that patients with a reactive AST showed good fetal outcome if delivered within one week of performing the test. The predictive value of AST is improved by arousing the fetus by auditory stimulation and thus reducing the false positive results seen in the other tests.

### INTRODUCTION

Amongst the various tests available for assessing fetal wellbeing like OCT, NST, etc, Acoustic stimulation test (AST) was first described by Grimwade et al. In 1971. In this test, acceleration of fetal heart following a

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sound stimulus is indicative of fetal wellbeing

Many different types of sound sources have been used in AST ranging from door bell, buzzer to tweeter to oscillometer to audio meter. We undertook a clinical trial in which we used artificial larynx as the source of sound stimulus and studied the reliability of this test in predicting fetal well being.

**MATERIAL AND METHODS**

AST was performed on 135 patients selected from Antenatal Clinic of Lok Nayak Jai Prakash Narain Hospital, New Delhi, in the year 1989-1990.

These included 73 high risk patients and 62 low risk patients. Criteria of high risk patients included:

- a) P.I.H.- Pregnancy induced Hypertension
- b) IUGR - Intrauterine growth retardation
- c) BOH - Bad Obstetric History

In many patients there was more than one indication for performing the test as shown in Table 1.

TABLE I

Indications	NO	%
Low Risk	62	45.9%
High Risk	73	54.1%
PIH	33	24.4%
BOH	14	10.4%
IUGR	11	8.2%
PIH +BOH	7	5.2%
PIH +IUGR	7	5.2%
PIH +BOH +IUGR	1	0.7%
Total	135	100%

All patients selected for the study were in their third trimester with singleton pregnancy when they were subjected to AST. The results of this test, according to literature, is

predictive of fetal outcome within one week. Hence, those patients not delivering within the week following the conductance of the test had to undergo repeated testing till delivery. Thus a total of 167 ASTs, were performed. The fetus was stimulated in this test by means of a trans-abdominally applied vibro-acoustic stimulus using the 5 C Electronic Artificial Larynx (EAL). Sound pressure levels of this device measured at one metre in air, averaged at 82dB. Its spectral analysis revealed a fundamental frequency of approximately 80 HZ, and harmonics ranging from 20 to 9000 HZ. The patient was put in 30 semi-fowlers position to avoid supine hypotension. The external fetal heart rate transducer was placed at the site where the fetal heart was best heard. The fetal movements were recorded by displacement of the labor transducer shaft

After establishing a baseline FHR for 5 minutes, the artificial Larynx was applied to the maternal abdomen in the region of the fetal head. A stimulus was given for 3 seconds. It was important to give the stimulus at the period when no spontaneous acceleration was occurring. If no qualifying acceleration was noted, the stimulus was repeated at 1 minute intervals for a maximum of three times.

The AST results were interpreted as follows:

**REACTIVE**

If either of following is observed within 15 seconds of stimulation.

1. Two 15 b.p.m. acceleration, each of atleast 15 seconds duration the first starting within 10 seconds of the stimulus, in a 10min ute period after stimulation.

2. Single prolonged 15 b.p.m. accelera-

tion of greater than 2 minutes duration starting within 10seconds of the stimulus.

#### NON REACTIVE

1. Borderline: 10 -14 bpm. acceleration
2. Abnormal (poor response) :<10bpm. acceleration.
3. Abnormal (non response): absence of acceleration

The results of AST were correlated with the following parameters.

1. Fetal distress during labor as judged by :
  - a) Meconium staining of liquor.
  - b) Drop in FHR below 120 bpm.
- II. Apgar of the baby at 1 minute and 5 minutes.
- III. Survival or death of the fetus.
2. Average time required for the test was calculated.

Results TABLE-II-III-IV-V

TABLE II

#### RESULTS OF AST PERFORMED WITHIN ONE WEEK OF DELIVERY

Ast	No.	%	Perinatal Deaths
Reactive	127	94.1%	0
Non-reactive	8	5.9%	1
Total	135	100%	

#### DISCUSSION

In our study, the AST results correlated well with intrapartum parameters of fetal well being. While our study yielded a reactivity rate for the test of 94.1% and non-reactivity rate of 5.9% (Table -II) in a comparative study serafini et al (1984) found that 132 (82.5%) of the 160 AST's were reactive where as 27 (16.9%) were nonreactive. A probable explanation for this lies in the fact that while Serafini et al (1984) had used an oscillating amplifier which delivered an acoustic stimulus of 1,220 HZ with a sound pressure level of 126 dB, we in our study had used a vibroacoustic stimulus, unlike the pure tone stimulus of Serafinis Study. The better response to this type of stimulus is further supported by Sontag & Wallace (1935) who concluded that a combination of sound and vibration was necessary to effectuate a consistent fetal response. When AST was reactive 90.6% (Table IV) showed no drop in intrapartum heart rate, 80.3% (Table III) had no meconium staining and 94.5% (Table V) had apgar score of more than 6 at 1 minute. When AST was nonreactive, 62.5% had meconium staining and 50% had drop in intrapartum fetal heart rate (Table III & IV) and 50% had apgar score of less than 6 at 1 minute (Table IV) A reactive AST means that the obstetrician can allow the pregnancy to continue whereas a nonreactive reponse should put the doctor on alert. However our study revealed that the test had false positive and false negative results and the doctor would be better advised to complement it with other tests. To exemplify this further, we observed that of the patients with a reactive AST, 19.7% showed the presence of meconium and 9.4% showed intrapartum fetal heart rate distress (Ref. Table III & IV). The perinatal outcome however, was good. The babies survived and the apgar score was more than 8,

TABLE III

## CORRELATION OF AST RESULTS WITH MECONIUM STAINING

AST	No. Of Patients	With Meconium		Without Meconium	
		No.	%	No.	%
Reactive	127	25	19.7	102	80.3
Non-reactive	8	5	62.5	3	37.5

TABLE IV

## CORRELATION OF AST RESULTS WITH INTRAPARTUM FETAL HEART RATE DECELERATION

AST	No. of Patients	Fall in Intrapartum		No fall in Intrapartum	
		No.	%	No.	%
Reactive	127	12	9.4%	115	90.6
Non-reactive	8	4	50%	4	50%

TABLE V

## RESULTS OF AST IN RELATION TO APGAR SCORE

AST	No. of Pts.	>6at 1 minute		0-6 at 1 min.		>6at 5 min.		0-6 at 5 min.	
		No.	%	No.	%	No.	%	No.	%
Reactive	127	120	94.5%	7	5.5%	125	98.4%	2	1.6%
Non-reactive	8	4	50%	4	50%	6	75%	2	25%

thus, a healthy clinical outcome supported the results or reactivity obtained by the AST results, despite the presence of meconium and intrapartum fetal heart rate deceleration. This statement is not meant to contradict the well known fact that alteration in the fetal heart rate

and passage of meconium are features of fetal distress. This then implies the existence of mechanisms other than anoxia for the presence of these features. Pressure on the fetal head, by hand or forceps, can cause slowing of the heart rate, This had been demonstrated

experimentally by Hon (1958) and Yagi (1954). Passage of meconium can also be due to the vagus reflex which, besides increasing bowel motility can also produce slowing of the fetal heart (Fenton and Steer-1962).

TABLE VI Our study showed only one antepartum death in nonreactive group at 35 weeks of pregnancy. The fetus showed multiple malformations on ultrasound examination hence caesarian section was not offered to the patient. Total mean duration of the reactive test was 7.314 minutes which was much less than time required for other tests available for Fetal surveillance.

TABLE VI

**CORRELATION OF AST RESULTS  
WITH MEAN TEST DURATION**

Test	Mean Duration (minutes)	S.D.
Reactive	7.314	1.203
Non-reactive	15	0

The AST is a modified stress test which awakens the sleeping fetus and there by helps to reduce the high false positivity of the other tests. AST is a simple test, less time consuming, without any contra-indications and can be performed in the office setting. Our study highlights the many advantages of the artificial larynx as the source of auditory stimulus. Besides being cheap, It is easy to handle and operate. Hence AST forms one of the ideal and reliable method of mass fetal surveillance.

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