

FETAL ACTIVITY DETERMINATION AND NEOSYNEPHRINE TEST FOR EVALUATION OF FETAL WELL-BEING IN HIGH RISK PREGNANCIES

Katsuto EGUCHI, Masaru YONEZAWA, Toshimi HASEGAWA, Tai Tung LIN,
Kohei EJIRI, Takafumi KUDO and Kaoru SEKIBA

Department of Obstetrics and Gynecology, Okayama University School of Medicine, Okayama
Yoshihiko TAKEDA

Department of Obstetrics and Gynecology, Kochi Medical School, Kochi

Synopsis At the special outpatient clinic for high risk pregnancies, a total of 197 patients were evaluated with fetal activity acceleration determination (FAD) as a non stress test. FAD was done on 197 patients, of these there were 8 fetal distress (4.7%) and 3 low Apgar scores (1 minute Apgar score less than 6) (1.8%) of 169 positive FAD, on the other hand, 14 fetal distress (50%) and 10 low Apgar scores (35.7%) of 28 negative FAD.

NEOSYNEPHRINE TEST was performed in 62 cases as a stress test and the correlation between these two tests was evaluated. In 51 instances FAD was positive and the simultaneous NEOSYNEPHRINE TEST was normal. In 2 cases of negative FAD with positive NEOSYNEPHRINE TEST, there were 2 fetal distress (100%) and 2 low Apgar scores (100%).

All the two tests are reliable for fetal evaluation in high risk pregnancies, because FAD and NEOSYNEPHRINE TEST are less time consuming and have fewer contraindications. It is concluded that the combination of these two tests are the most useful screening methods for fetal evaluation in high risk pregnancies.

Key words: FAD • NEOSYNEPHRINE TEST • High risk pregnancies • Fetal well-being

Introduction

The purpose of management in obstetrics is to keep both the mother and fetus in a safe environment. By means of the improvement of endocrinological and biochemical examinations for feto-placental function and the widespread use of the fetal heart rate (FHR) monitoring, the perinatal mortality rate seems to be decreased rapidly and markedly. But there are still some troubles and abnormalities occurred easily during delivery and some physico-mentally disturbed infants born, revealing that the intensive care needed in obstetrics, especially in high risk pregnancies remains. It means that the antepartum and intrapartum care of high risk pregnancies are still a very important subject. So that, the accurate evaluation of fetal well-being and maturity is essential in the management of high risk pregnancies.

For this purpose, we designed a special obstetric outpatient clinic for high risk patients to

detect the perinatal abnormalities and to improve a prognosis of high risk pregnancies. This paper reports about the functioning of the intensive care unit in our outpatient clinic, including the results of non stressed FHR monitoring and NEOSYNEPHRINE TEST applied in it, and discusses about the frequency of the perinatal abnormalities.

Materials and Methods

From September 1976 until March 1979 at Okayama University School of Medicine, we had 197 cases of high risk patients recorded with the FHR monitoring by the equipment of Hewlett Packard co. within 1 week prior to delivery. To record the FHR, an ultrasonic transducer was employed. The classifications of high risk patients are elaborated in Table 1 and 2. Patients were maintained in semi-Fowler's position to avoid supine hypotension, and blood pressure was taken frequently.

Table 1. Indication for FAD

Indication	No. of cases
Postdate pregnancy	40
Toxemia of pregnancy	29
Premature rupture of membranes	23
Threatend premature labor	13
Diabetes mellitus	
Class A	9
Class B	3
Class C	1
Previous caesarean section	8
Previous fetal or neonatal death	6
Suspected fetal dysmaturity	5
Placenta previa	5
Low urinary esteriol	4
Elderly primigravida	2
Miscellaneous	44
Total	197

Table 2. Indication for NEOSYNEPHRINE TEST or Simultaneous FAD

Indication	No. of cases
Postdate pregnancy	36
Toxemia of pregnancy	6
Diabetes mellitus	
Class A	4
Class B	1
Class C	1
Previous fetal or neonatal death	4
Low urinary estriol	4
Elderly primigravida	2
Hyperthyroidism	1
Hypothyroidism	1
Hypoparathyroidism	1
Suspected fetal dysmaturity	1
Suspected cephalopelvic disproportion	1
Total	62

First, we carried out non stressed FHR monitoring for 30 minutes to evaluate a transient acceleration with fetal movement for the fetal activity determination, then the NEOSYNEPHRINE TEST was performed as a stress test. We discuss a relationship between the results of these tests and the perinatal abnormalities retrospectively. The perinatal abnormalities were focused on fetal distress and neonatal asphyxia (Apgar score is below 6 at 1 minute

after birth).

Fetal activity determination (FAD) is a kind of non stressed test applied to detect acceleration of FHR in response to fetal movement, so that we can evaluate the fetal well-being without adding any stress both to the fetus and mother. Fig. 1 reveals the normal (positive) FAD case which shows the accelerations of FHR for above 15 bpm, and the abnormal (negative) FAD case without any acceleration with fetal movement.

NEOSYNEPHRINE TEST is a kind of a stress test, i.e. administrating Neosynephrine to the mother for inducing the fetus to the transient hypoxic state, and then the FHR is recorded in order to check the FHR response following injection. The method and determinative standardization of this test is demonstrated in Table 3. A cases of positive (bradycardia type) NEOSYNEPHRINE TEST is

Fig. 1. Determinative standadization of FAD

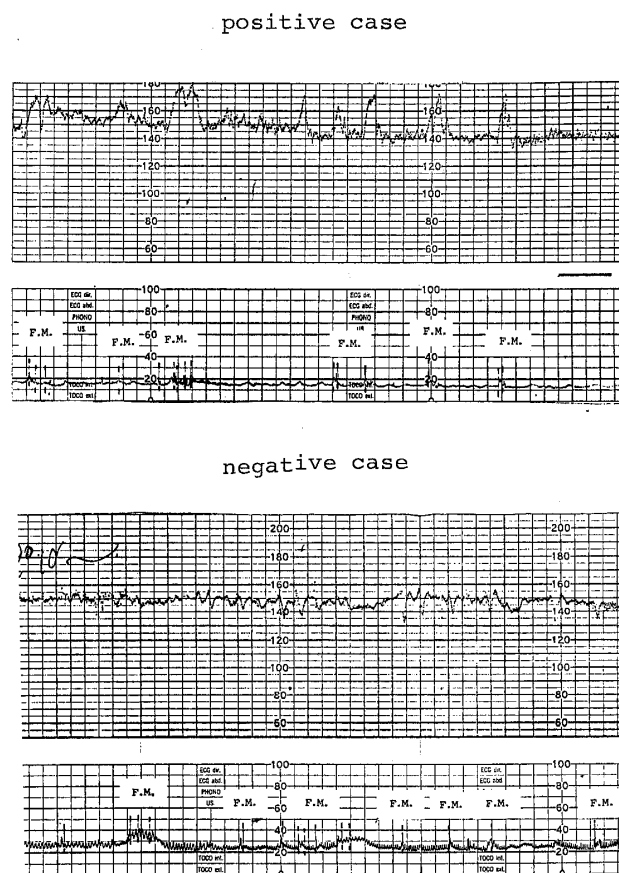


Fig. 2. Positive case (bradycardia type) of NEOSYNEPHRINE TEST

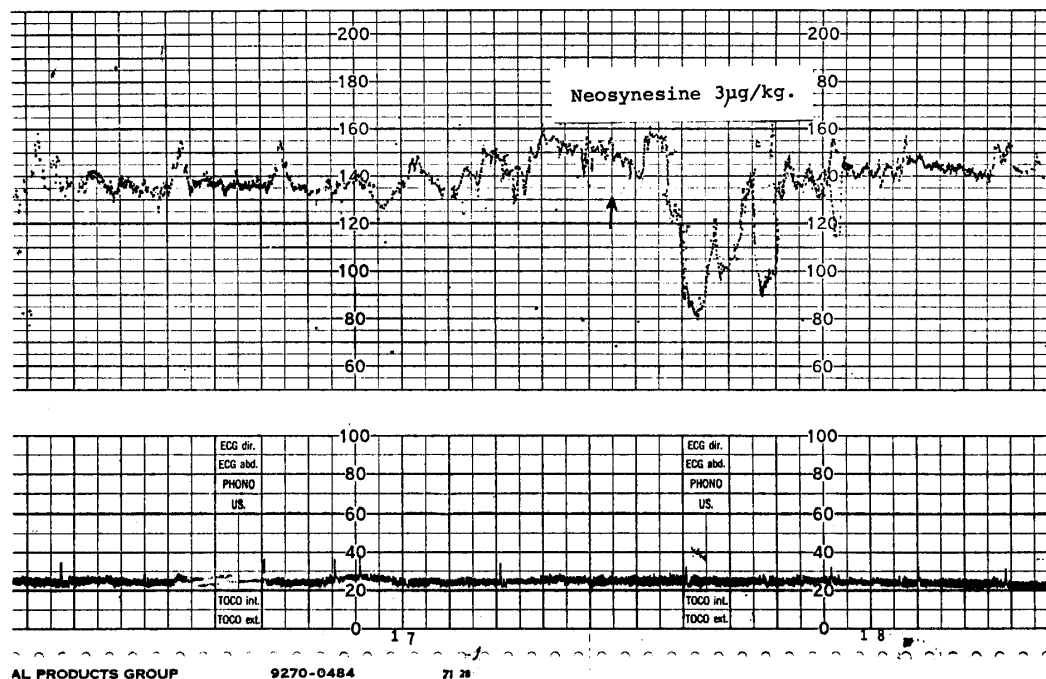


Table 3. Protocol of NEOSYNEPHRINE TEST

Method: keep the patients bet rest in Semi-Fowler's position for 5 minutes, then administer $3 \mu\text{g}/\text{kg}$ NEOSYNEPHRINE intravenously with continuous FHR monitoring.

Evaluation:

1. stable type (changes within 17 bpm.)
2. variable type (changes within 18 bpm.)
3. tachycardia type (tachycardia above 18 bpm. for more than 30 seconds)
4. bradycardia type (bradycardia below 18 bpm. for more than 30 seconds)

1., 2.: negative 3., 4.: positive

demonstrated in Fig. 2.

Results

1. Outcome of 197 cases with FAD

FAD was performed on 197 patients. In 169 cases, the FAD results were positive. In this group, there were 3 cases of neonatal asphyxia and 8 cases of fetal distress, but the remaining infants were all delivered in good conditions. On the contrary, in 28 cases with negative FAD results, there were 14 cases of fetal distress and

Table 4. Outcome of 197 cases with FAD

	positive FAD	negative FAD
No. of cases	169	28
Fetal distress	8	14
Neonatal asphyxia	3*	10+

*Apgar scores of 6 at 1 minute in 2 cases.

+ Includes one fetal death due to multiple anomalies.

10 cases of neonatal asphyxia respectively (Table 4).

2. Outcome of 62 cases with NEOSYNEPHRINE TEST

In 56 cases with negative NEOSYNEPHRINE TEST, there was only 1 case of neonatal asphyxia without fetal distress. The remaining fetuses in this group tolerated labor well. On the other hand, in 6 cases with positive NEOSYNEPHRINE TEST, there were 4 cases of fetal distress and 2 cases of neonatal asphyxia. The rate of the perinatal abnormalities in this group was much higher than in the negative group (Table 5).

3. Outcome of 62 cases combined with FAD and NEOSYNEPHRINE TEST

Table 5. Outcome of 62 cases with NEOSYNEPHRINE TEST

	negative	positive
No. of cases	56	6
Fetal distress	0	4
Neonatal asphyxia	1*	2+

*Apgar scores of 6 at 1 minute.

+All cases had the meconium staining.

Table 6. Outcome of 62 cases combined with FAD and NEOSYNEPHRINE TEST

	Group 1	Group 2	Group 3	Group 4
No. of cases	51	4	5	2
Fetal distress	0	2	1	2
Neonatal asphyxia	1	2	2	2*

*All cases had the meconium staining.

FAD and NEOSYNEPHRINE TEST were applied to 62 cases. In 51 instances, the FAD results were positive and the simultaneous NEOSYNEPHRINE TEST results were negative (Group 1). In this group, there was only 1 case of neonatal asphyxia without fetal distress, and the remaining fetuses were delivered in excellent condition. In 4 cases with positive FAD results, the simultaneous NEOSYNEPHRINE TEST was positive (Group 2). In this group, there were 2 cases of neonatal asphyxia with fetal distress. In 5 cases with negative FAD results and simultaneous negative NEOSYNEPHRINE TEST (Group 3), there were 1 case of neonatal asphyxia with fetal distress and 1 case of neonatal asphyxia without fetal distress. Finally, in 2 cases of negative FAD results and simultaneous positive NEOSYNEPHRINE TEST (Group 4), all of 2 infants developed severe neonatal asphyxia with fetal distress and meconium staining (Table 6).

Comments

For constructing a new practical system in the intensive care unit of high risk patients, we have made efforts in the preventive obstetrical researches and reviewed many reports about this topic. But we think there is still not enough

screening for evaluating the high risk pregnancy in spite of so many reports about it. The Perinatal Abnormality Screening Scores (PASS) reported by Takemura and associates¹¹⁾ has some predicting function for the perinatal abnormality. Kawada and associates³⁾ used a MCHC index for detecting risk factors of pregnant women in the outpatient clinic. They mentioned that it was very useful in prediction of operative delivery, premature labor, low birth weight infant in the outpatient clinic.

This time, we performed the FAD for the antepartum management following the screening of high risk pregnancies, which is a kind of non stressed FHR monitoring. This assumption is based on the fact that the accelerations in response to fetal movement are indicative of an intact and well-oxygenated central nervous system and secondary appropriate cardiac response.

Lee and associates⁴⁾ reported that positive FAD meant the FHR acceleration in relation to fetal movement more than 3 or 4 times, and that there were only 2 in 402 cases who had low Apgar scores below 6 at 5 minutes after birth. Ray burn and colleagues⁷⁾ concluded that any FHR acceleration during any fetal movement over a 20 minute period might be considered normal or positive, in spite of the frequency of acceleration, and that in the positive group, there were 3 in 131 infants with prior favourable fetal acceleration tests, who had low Apgar scores 4 to 6. Paul and associates⁵⁾ monitored the patients for 20 minutes, and stated that a reactive pattern should be more than 5 accelerations above 15 bpm with fetal movement. But there may be no certain standardization about interpretation of FAD now.

As for non stressed test, there is not only FAD but also baseline variability used for assessment of fetal well-being. Rochard et al.⁸⁾ and associates divided the baseline variability or the acceleration in response to fetal movement into reactive, nonreactive, sinusoidal and combined patterns. For these 4 categories of patterns, there were 41 cases of 51 reactive pattern, who had no fetal distress nor neonatal morbidity.

On the other hand, in 39 nonreactive pattern or sinusoidal pattern, there were 15 cases, who developed fetal death or neonatal death finally. The same kind of reports have been published by Visser et al.¹³⁾, Sill et al.⁹⁾, Trierweich et al.¹²⁾, Hammacher et al.²⁾, Fisher¹⁾ and Pearson et al.⁶⁾.

There is no doubt that non stressed FHR monitoring is a useful method to evaluate the intrauterine fetal status for high risk pregnancies, in spite of many different determinative standardizations. But there are still many problems for solving non stressed FHR monitoring, because acceleration is not always associated with fetal movement. The mechanism of acceleration is not definitely understood yet, and another problem is that the different types of equipment have their own peculiar characteristics for determination. In addition, the intrauterine state of the fetus, on alert or sleepy, is also an important problem. The FHR pattern may be influenced by gestational age and the intake of some drugs of the mother, thus all of these problems should be resolved in the near future.

There are many reports about FAD and Oxytocin Challenge Test (OCT), and positive FAD with negative OCT correlates well with fetal well-being and good subsequent fetal outcome. So that, if FAD is negative, they use OCT. This means that OCT is a strong indication as a screening test of FAD, but because OCT would not be a completely safe method for the fetus, and some sensitivity errors will appear in some cases. OCT can not make a constant data and it takes much time too. For this reason, we use NEOSYNEPHRINE TEST only as a stress test. NEOSYNEPHRINE TEST has been used for more than 10 years in our clinic. It is an indirect measure of fetal well-being and placental oxygen reserve or respiratory function¹⁰⁾, and a reliable clinical procedure for managing high risk pregnancies.

In reviewing FAD and NEOSYNEPHRINE TEST, we found that in cases of positive NEOSYNEPHRINE TEST alone, the occurrence rate of fetal distress or neonatal asphyxia was

very high. In the FAD, the results were almost the same as Lee, and Rayburn's reports, i.e. in the positive FAD group, the occurrence rate of neonatal asphyxia was very low, but in the negative FAD group, the occurrence rate of the perinatal abnormalities was much higher than in the positive FAD group.

Combining these two tests, the both abnormal FAD and NEOSYNEPHRINE TEST group had a much higher rate of the perinatal abnormalities than one abnormal test only, respectively. From this standpoint, it may be concluded that the combination of both tests is very useful for evaluation of fetal well-being and fetal reserve in high risk pregnancies. Especially, if another examination is combined besides the FHR monitoring, it is expected to get a much better diagnostic rate about fetal well-being.

References

1. Fisher, W.M.: Vorschlag zur Beurteilung des antepartualen Kardiotokograms. Z. Geburtsh. Perinat., 180: 117, 1976.
2. Hammacher, K., Brun del Re, R., Gaudenz, R., De Grandi, P. and Richter, R.: Kardiotokographischer Nachweis einer fetalen Gefährdung mit einem CTG-Score. Gynäk. Rdsch. 14, Suppl., 1: 61, 1974.
3. Kawada, K. and Takeda, Y.: Evaluation of high risk pregnancy with a M.C.H.C. index and Labor index. Nissanpu Chugoku Shikoku-Zassi, 25: 81, 1976.
4. Lee, C.Y., DiLoreto, P.C. and Logrand, B.: Fetal activity acceleration determination for evaluation of fetal reserve. Obstet. Gynecol., 48: 19, 1976.
5. Paul, R.H. and Miller, F.C.: Antepartum fetal heart rate monitoring. Clinical Obstet. Gynecol., 21: 375, 1978.
6. Pearson, J.F. and Weaver, J.B.: A six-point scoring system for antenatal cardiotocographs. Br. J. Obstet. Gynecol., 85: 321, 1978.
7. Rayburn, W.F., Duhring, J.L. and Donaldson, M.: A study of fetal acceleration test. Am. J. Obstet. Gynecol., 132: 33, 1978.
8. Rochard, F., Schifrin, B.S., Goupil, F., Legrand, H., Blottiere, J. and Sureau, C.: Nonstressed fetal heart rate monitoring in the antepartum period. Am. J. Obstet. Gynecol., 126: 699, 1976.
9. Sill, H. and Wilson, E.W.: Antepartum fetal heart rate monitoring. Aust. N.Z. J. Obstet. Gynecol., 15: 132, 1975.
10. Takeda, Y., Kudo, T. and Takada, T.: Neosynephrine Test. Sankatofujinka, 38: 1320, 1971.

11. *Takemura, A. and Kurachi, K.*: Evaluation of high risk pregnancy. *Sanfujinkanojissai*, 24: 1065, 1975.
12. *Trierweiler, M.W., Freeman, R.K. and James, J.*: Baseline fetal heart rate characteristics as an indicator of fetal status during the antepartum period. *Am. J. Obstet. Gynecol.*, 125: 618, 1976.
13. *Visser, G.H.A. and Huijjes, H.J.*: Diagnostic value of the unstressed antepartum cardiotocogram. *Br. J. Obstet. Gynecol.*, 84: 321, 1977.

(Accepted: No. 4600, October 11, 1979)

概要 当科においては従来より産科特殊外来を設け、特に high risk pregnancy 妊婦に対して、各種検査を組み合わせて胎児評価をすることにより周産期異常発生予知のスクリーニングに努めている。今回197例の high risk pregnancy 妊婦を対象として、non stressed FHR monitoring としての fetal activity acceleration determination (FAD) と負荷試験としてネオンネフリンテストの2つの検査により周産期異常の発生頻度について retrospective に解析を試みた。

単独検査による周産期異常発生頻度をみると、FAD 197例中 FAD 異常は28例、そのうち胎児仮死は14例 (50%)、一方169例が正常で、そのうち新生児仮死3例 (1.8%) が発生した。ネオンネフリンテスト62例中異常は6例で胎児仮死は4例 (66.7%)、新生児仮死2例 (50%)、一方ネオンネフリン正常例56例のうちでは新生児仮死が1例発生したのみであつた。両検査を組み合わせると、両検査とも正常な51例では新生児仮死1例のみ、逆に両検査とも異常は2例あり、2例とも胎児仮死及び新生児仮死が発生した。

以上の結果、FAD 及びネオンネフリンテストは的中率の高さ、安全性よりみて high risk pregnancy における胎児評価、周産期異常発生予知のスクリーニングに極めて有用であることが認められた。