

# Non-stress test: a fifteen-year clinical appraisal

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Received October 28, 1996; revised manuscript accepted for publication February 8, 1997

## Summary

During a 15-year period (Jan. 1981 to Dec. 1995) a total of 14,950 patients were delivered in our hospital. Throughout this period fetal heart rate monitoring during labor was increased from 10% up to 85%. The overall antepartum testing was also increased from 8 to 15%. In patients with significant complications in pregnancy the mean number of non-stress tests (NST's) per patient was 1.8 tests in 1981 to 4.8 tests in 1995. The average perinatal mortality was 15.2‰, with a gradual decline. In patients who were subjected to antepartum testing the previous rate was only 3.7‰.

Our conclusion is that the use of antepartum and intrapartum cardiotocography has increased during the last 15 years in our clinic. As a consequence a considerable decrease was noted in the overall perinatal mortality. The non-stress test is still today the first line of antepartum fetal assessment.

*Key words:* Non-stress test; Fetal surveillance; Cardiotocography.

## Introduction

Fetal evaluation in pregnancy and especially in high risk patients with antepartum fetal heart rate (FHR) testing has been proved to be a successful method for fetal surveillance [1, 2]. Following the observation that the loss of autonomically controlled FHR acceleration, after fetal movement, was associated with a increased incidence of a positive oxytocin challenge test (OCT) [3, 4, 5], several authors applied this concept clinically as the non-stress test (NST) [6, 7, 8]. Since its introduction it has offered the benefit of reducing perinatal morbidity and mortality [9, 10, 11]. The NST soon became popular because as an antenatal examination it offers the following advantages; a) a relatively short time to complete the test, b) it is non-expensive, c) there are no contra-indications, d) it is easy to evaluate, e) it does not often need repetitions in case of suspicious findings or uterine hyperstimulation, in contrast to OCT and, f) it can be applied in every office without problems [12, 13, 14, 15].

Our 15-year experience in applying the NST in everyday obstetrical practice is presented.

## Materials and Methods

During the past 15 years (January 1981 to December 1995) a total of 14,950 women delivered in our clinic. Throughout these years intrapartum fetal heart rate monitoring application has increased from 10% to 85%. During this period 1,350 patients were subjected to antenatal fetal assessment in our clinic. The overall number of tests has gradually increased from 8% to 15%. The mean number of test patient has been raised from 1.8 to 4.8 (Figure 1). All patients were delivered within one week from the last test. The NST has been the main test for evaluation. A total of 1,030 patients were low-risk pregnancies and 320 high risk pregnancies. Its indications for application in high risk pregnancies are shown in table 1. Antepartum FHR testing was applied in 1,350 patients who were of at least 33 weeks in gestational age. Mean gestational age was 40.5 weeks (ranging from 33 to 42 weeks).

In the present study the following perinatal outcome parameters were taken into consideration: 1) Fetal death and 2) intrapartum fetal distress (Apgar score less than 6 at one and five minutes, FHR pattern with severe, variable, late or prolonged decelerations, fetal scalp or umbilical arterial pH less than 7.20).

We used Corometrics 115 electronic monitors. Fetal movements were entered by the patient, using a remote event indicator. The interpretation was made according the criteria proposed by Evertson *et al.* [14] and Keegan *et al.* [16]. The NST was allowed to continue until either a reactive pattern was obtained or a period of 40 minutes was over. The acoustic stimulation test (AST) was later introduced (since January 1987) and as a result, false non-reactive tests were minimized while the duration of the test was shortened [17].

## Results

Of the last before labor NST's in 1,030 low-risk patients, 1,009 (98%) were reactive and 21 (2%) non-reactive (Table 2). One neonatal death due to postmaturity syndrome occurred in the group with reactive NST's (perinatal mortality rate 0.9‰). All the remaining patients with either reactive or non-reactive NST's had an uneventful labor with healthy neonates.

In the group of 320 high-risk patients, 276 NST' (86.2%) were reactive and 44 (13.8%) non-reactive. Four neonatal deaths occurred in this group of non-reactive NST's, yielding a perinatal mortality rate of 12.5‰. One death was attributed to post-maturity syndrome, one to meconium aspiration and two to intrauterine asphyxia due to intrauterine growth retardation (IUGR).

In the group of high-risk pregnancies with non-reactive NST's we had 28 cases with poor perinatal outcome, presenting severe FHR decelerations, low Apgar score and/or umbilical cord artery pH<7.20 (Table 3). In total, 32 patients from the group with non-reactive NST's (n=65) presented poor perinatal outcomes. On the contrary, only one fetal death occurred in the group of 1,285 patients with reactive NST's.

During this 15-year period we had 228 perinatal deaths in a total of 14,950 deliveries. Our overall perinatal mortality rate was 15.2‰. Comparing the perinatal mortality rate (16.3‰) of 13,600 patients who had no antenatal NST to 1,350 patients who were subjected to antepartum fetal assessment whose perinatal mortality was 3.7‰, we noted a considerable decrease, which must be connected to the use of NST.

Table 1. — *Indications for NST*

Diagnosis	n	%
Low risk	1030	76.29
Postdates	158	11.70
Preeclampsia	55	4.07
IUGR	33	2.44
Diabetes mellitus (class A-C)	32	2.37
Decreased fetal movements	21	15.55
Chronic hypertension	3	0.22
Poor obstetric history	3	0.22
Hyperthyroidism	3	0.22
Miscellaneous medical and obstetric complications	12	0.88
Total	1350	100

Table 2. — *Patients subjected to NST (n=1350)*

	Low-risk (n=1030)	High-risk (n=320)	Total
Reactive NST	1009 (98%)	276 (86.2%)	1285 (95.2%)
Non-reactive NST	21 (2%)	44 (13.8%)	65 (4.8%)
Neonatal deaths	1 (0.9‰)	4 (12.5‰)	5 (3.7‰)
Poor perinatal outcome	4 (0.38%)	28 (8.75%)	32 (2.37%)

Table 3. — *Poor perinatal outcome in cases of high-risk pregnancies with non-reactive NST's*

Clinical problem	No	Severe variable, late or prolonged decelerations	Apgar score <6	Umbilical arterial pH<7.20
IUGR	17	15	9	7
Postdatism	5	5	4	4
Hypertension	4	3	2	2
Diabetes mellitus	1	—	1	1
Placental abruption	1	1	1	1

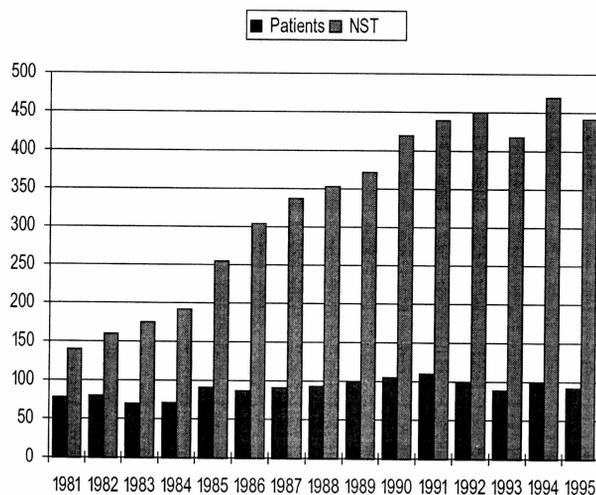


Figure 1. — Number of NSTs per patient in a 15-year period.

## Discussion

Since hypoxia has a definite result on fetal heart rate, antepartum cardiotocography is one of the main diagnostic tools in recognizing the fetus at risk [18]. Antepartum cardiotocography offers valuable information concerning the timing of labor induction [11]. Intrapartum cardiotocography creates optimal conditions for fetal surveillance during labor [19]. Fetal death rate, after antepartum testing in selected high-risk patients, is significantly lower in patients subjected to NST's than in patients who were not tested [10].

It seems that the increase in the number of tests per patient and the improvement in NST interpretation, as well as the overall improved obstetric care for high-risk pregnancies have contributed to diminishing fetal death. In our clinic perinatal mortality was 15‰ during the first five years of intrapartum cardiotocography application and to day it has declined to 14.8‰. Moreover, in women who were also subjected to antepartum cardiotocography perinatal mortality rate was 3.7‰, but in high-risk pregnancies the rate was still high, reaching 12.5‰.

The NST is an indirect but reliable test for diagnosing fetal hypoxia, which is a main problem in high-risk pregnancies. Acute hypoxia results in diminishing or even eliminating fetal movements [20]. As a consequence FHR accelerations are absent, which results in a non-reactive NST – a significant sign of impending danger to the fetus [9, 21]. The presence of a non-reactive NST must be verified with an AST which should result in being non-reactive, or by repetition of the NST after six hours. In our study the rate of non-reactive NST's in low-risk patients was 2%. These patients had a normal perinatal course and their neonates were healthy. On the contrary, in high-risk patients the rate was 13.8%. Out of these patients, 32 cases had poor perinatal outcome and fetal deaths.

According to several authors the major problem of antepartum testing is high specificity but low sensitivity. Criteria for the non-stress test interpretations which rely solely on minimum counts of acceleration, result in a relatively low test sensitivity [9]. Despite older studies mentioning a greater than 50% ability of the test to predict increased morbidity or mortality [22], the non-stress test is still today the first line of antepartum fetal assessment [9]. We also believe that clinical management of pregnancies at risk must be based on sound clinical judgment, supported by adjunctive antepartum testing procedures – where the NST dominates.

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