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Editorial
Nonstress Test

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Antepartum fetal assessment is a very important aspect of the current antenatal care system. The goal of antepartum fetal surveillance techniques is to prevent antenatal and perinatal fetal morbidity and mortality.

Nonstress test is defined as a graphic representation of the baseline fetal heart rate, the beat to beat variability, accelerations and decelerations with respect to fetal movements and Braxton Hicks Contractions.

Among the various methods of antepartum testing that are uses today, the nonprovocative tests NST, biophysical profile and modified biophysical profile are safe and effective for use in outpatient settings. Introduced by Freeman RK, Lee CV et al[1] in 1975, this test is based on the pinciple of recording doppler detected fetal heart rate acceleration coincident with fetal movements perceived by the mother. By the end of the 1970's, the contraction stress test was supplanted by the nonstress test as the primary method of testing fetal health. In simple words, the nonstress test is primarily an indicator of fetal health whereas the contraction stress test is an indicator of the uteroplacental function. Over the last three decades, the nonstress test has become one of the most widely used methods for assessment of antenatal fetal well being. Antepartum fetal surveillance techniques are routinely used to assess the risk of fetal death in pregnancies complicated by preexisting maternal medical diseases as well as those pregnancies in which complications have developed during the course of the pregnancy.

In order to correctly interpret the nonstress test, it is important to understand the physiology of fetal heart rate acceleration. The fetal heart rate increases or decreases on a beat to beat basis under the influence of the autonomic nervous system mediated by the sympathetic or the parasympathetic impulse from the brainstem centres. The acceleration of the fetal heart rate with fetal movement is an indication of the fetal autonomic function. Thus, any pathological loss of fetal heart acceleration may be seen in conjunction with loss of beat to beat variability. However the beat to beat variability may also be affected with sleep cycles or with central nervous system depression by drugs. Thus, the interpretation of the nonstress test is based on the fact that in a fetus not compromised by hypoxia or neurological depression, there is a temporary acceleration of the fetal heart rate with fetal movement. The changes in the fetal heart rate patterns are also affected by the gestational age. The dominance of the sympathetic influences in early third trimester is reflected by a higher baseline fetal heart rate at this gestational age. With increasing gestational age, the percentage of body movement which are accompanied by accelerations as well as the amplitude of these accelerations also increases Pillai M. and James D[2]. Also it was initially thought that only those accelerations which are associated with documented fetal movement are significant. However, in the mid 90's studies conducted by Devoe et al[3] and Stanco et al[4] showed that accelerations on NST are indicative of fetal well being irrespective of maternal perception of fetal movements.

Fetal heart rate monitoring is indicated in any situation where there is a risk of fetal hypoxia which may acutely arise in placental abruption or fetomaternal haemorrhage or develop in chronic conditions like preeclampsia, rhesus isoimmunisation etc. The reason behind performing the test plays an important role in the successful interpretation of CTG. Acute hypoxic states like placental abruption will show profound bradycardia in contrast to slowly progressive hypoxic states which will show a loss of beat to beat variability and accelerations keeping the baseline heart rate normal. Thus it is based, on the fact that the slower the interruption of the oxygen delivery to the fetus, the more likely will be the adaptation by the fetus to the hypoxic state. Following is a brief review of various clinical states likely to cause fetal hypoxia and consequent changes in the NST.

Placental abruption can occur in the antepartum or intrapartum period. The effect on the NST depends upon the rate at which the oxygen delivery is hampered. A slow placental abruption in labour is seen as diminishing variability with late decelerations as against an acute severe abruption which shows significant fetal bradycardia with high chance of neonatal asphyxia if the fetus is born alive.

Placental infarction, if large or recurrent, may lead to reduced placental functions. Acute placental infarction is characterised by fetal tachycardia with decreased beat to beat variability which settles over a period of few days. Subsequent follow up with NST is necessary to demonstrate that the infarction is not progressive. It is also necessary to prevent growth retardation by appropriate subsequent management.

Placental insufficiency leading to fetal growth retardation is clinically more recognised. Placental insufficiency usually exists before growth retardation begins. The fetal adaptive mechanisms begin before the fetus starts to undergrow. Thus a mild placental insufficiency may not slow the fetal growth but there may be diminished reserve and therefore tolerance to normal labour which may be reduced in these fetuses. The process of fetal adaptation is reflected on the NST by a series of changes viz reduced accelerations inspite of perceived fetal movements, decelerations with Braxton thick contractions and reduced variability with baseline tachycardia due to reducing fetal oxygenation. These findings are omnious in women presenting with reduced fetal movements.

NST also plays a role in specific clinical conditions like isoimmunized pregnancies, postdated pregnancies etc. Ouzounios et al[5] studied the need for neonatal transfusion in sixty patients with isoimmunisation over a three year period. Their data suggested that NST had a 77.8% positive predictive value in identifying the need for neonatal transfusion in these patients.

In postdated pregnancies, NST has to be interpreted in combination with amniotic fluid volume and biophysical profile. Amniotic fluid volume probably is a more sensitive marker in these patients. A study of forty five postdated pregnant women by Danaraway[6] in 1993 recommends that sonography assessment of amniotic fluid volume along with NST is an ideal antepartum surveillance method in these patients.

Electronic fetal monitoring is also useful in preterm pregnancies as a screening method for prediction of intrapartum asphyxia. A prediction of fetal asphyxia that leads to intervention and delivery may prevent or modify moderate or severe morbidity in newborn as a result of fetal asphyxia in preterm infants Low et al[7].

Fetal vibroacoustic or manual stimulation has been used as a method of changing fetal sleep state during NST. The ability of vibroacoustic stimulation to elicit FHR accelerations has been established thus decreasing the false positive rate associated with nonreactive NST. Short term fetal acoustic stimulation (short FAST) has a high specificity for negative predictive value and accuracy for prediction of poor perinatal outcome.

Thus, we see that nonstress test has a major role to play in the currently existing antepartum care system. Large studies have confirmed that fetal death rate among patient undergoing antepartum testing is significantly lower than that in the general untested population. In future, protocols using adjunctive testing methods like doppler velocimetry and fetal movement profile along with the standard methods may further reduce the incidence of fetal death in high risk populations.

References :

1. Lee CV., Diloreto PC., O'Lane JM; A study of fetal heart rate acceleration patterns : Obstet Gynecol 1975; 45: 142 - 6.
2. Pillai M., James D : The Development of fetal heart rate patterns during normal pregnancy. *Obstet Gynecol 1990 ; 76: 812 - 5.*
3. Devoe L. Boehm F., Paul R., Frigoletto F., Penso C., Goldenberg R., Raybum W., Smith C., Clinical experience with Hewlett Packard M - 1350 A fetal monitor correlation of doppler detected fetal body movements with fetal heart rate parameters and perinatal outcome. *Am J Obstet Gynecol 1994; 170: 660 - 3.*
4. Stanco L. M., Rabello Y., Medearis AL., Paul RH., Does Doppler detected fetal movement decrease the incidence of non reactive non-stress tests ? *Obstet Gynecol 1933; 82: 999 - 1001.*
5. Ouzounios JG., Alsulyman OM., Montelro HA., Songster GS., The non reactive nonstress test; predictive value for neonatal anaemia in the isoimmunized pregnancy. *Obstet Gynecol 1996 ; 88: 364 - 7.*
6) Et - Damarawy H., et Sibaie F., Tawfik TA., Antepartum fetal Surveillance in post dated pregnancy. *J Gynecol Obstet 1993; 43: 145 - 150.*
7) Low JA., Killen H., Derrick EJ., The prediction and prevention of Intrapartum fetal asphyxia in preterm pregnancies. *Am J Obstet Gynecol 2002; 186: 279 - 282.*