

## High Risk Pregnancy Outcomes in Upper Egypt: Umbilical Artery Doppler Versus Non Stress Test

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### Abstract

**Background:** The exact magnitude of the perinatal morbidity and mortality problems from high risk pregnancy in upper Egypt is one of the most important problems.

**Objective:** to evaluate non stress test (NST) and umbilical artery Doppler (UAD) as ante natal screening tests in high risk pregnancies.

**Patients and methods:** 200 high risk pregnant women from upper Egypt were divided into two equal groups for each either NST or UAD was performed twice one week apart if the 1<sup>st</sup> test was abnormal.

**Results:** Abnormal test results were significantly higher in 1<sup>st</sup> & 2<sup>nd</sup> visits for NST group compared to UAD group (58% & 22% Vs 28% & 19% respectively  $p=0.000$ ). The rate of vaginal delivery was significantly higher in UAD group (73% Vs 61%  $p=0.002$ ), Cs for fetal distress was significantly higher in NST group (46% Vs 29.7  $p<0.05$ ), while successful induction of labor was statistically higher for UAD group (57.6% Vs 18.2%  $p <0.01$ ). UAD group was associated with statistically higher rate of APGAR scores  $> 7$  (98% Vs 85%  $p=0.003$ ), lower APGAR score  $< 4$  (2% Vs 15%  $p=0.003$ ) and lower admission rate to NICU (2% Vs 15%  $p=0.006$ ).

**Conclusions:** UAD as a screening test in high risk pregnancies is associated with better maternal and neonatal outcomes.

**Key words:** Umbilical artery Doppler, non stress test, high risk pregnancy, perinatal mor

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## Introduction

It is estimated that more than nine million infants die before birth or in the first few weeks of life each year nearly all of these deaths occur in developing countries <sup>(1)</sup>. Perinatal mortality rate in Egypt is about 45/1000 total births, compared with 11/1000 in the developed countries, most perinatal deaths are due to pregnancy and delivery-related complications. <sup>(2)</sup>. Several techniques for ante partum fetal surveillance are used to recognize fetal well being and compromised fetuses with different sensitivity and specificity levels. Those techniques include Maternal perception of fetal movement, non stress test (NST) and umbilical artery Doppler (UAD) velocimetry. Awareness of fetal movement is a means for the mother to monitor her fetus without the need for a clinician or equipment <sup>(3)</sup>. Decreased fetal movement is defined as the qualitative maternal perception of reduction of fetal movement <sup>(4)</sup>.

Heart rate reactivity in NST is believed to be a good indicator of normal fetal autonomic function. Loss of reactivity is commonly associated with a fetal sleep cycle but may result from any cause of central nervous system depression, including fetal acidosis <sup>(5)</sup>. Results of NST are classified as reactive or non reactive. The test is considered reactive if there are two or more fetal heart rate

accelerations within a 20-minute period, with or without fetal movement perception by the woman, the non reactive test lacks sufficient fetal heart rate accelerations over a 40-minute period <sup>(6)</sup>.

Umbilical artery Doppler (UAD) flow velocimetry has been adapted as a fetal surveillance technique because it is well known that umbilical flow velocity waveform of a normally growing fetus has high-velocity diastolic flow, while in cases of increased vascular impedance in the placenta the umbilical artery diastolic flow is diminished, the flow may be absent or even reversed, with a high perinatal mortality rate among such pregnancies <sup>(7)</sup>.

### **Aim of the study**

The aim of this study was to evaluate the role of NST and UAD measurements as an antenatal screening test of fetal well being in high risk pregnancies affected by decreased fetal movements in Upper Egypt as regard to rate of abnormal test results, successful induction of labor, cesarean section rate and fetal outcomes.

### **Patients and methods**

This study was conducted at fetal surveillance unit of obstetrics department of Al Azhar university hospital at Assiut, a governorate in upper Egypt, over 12 months period. 200 high risk pregnant women complaining of decreased fetal movements were enrolled in the study. The nature of this study was firstly explained for all participants before enrollment then a written consent was obtained.

### **Inclusion criteria**

age between 25-35 years, gestational age between 32 - 42 weeks, high risk pregnancies affected by anaemia, DM, preeclampsia, eclampsia, chronic hypertension or cardiac disease. Participants were subjected to proper history taking, general and obstetrics examinations, ultrasound

evaluation and routine investigations then they allocated randomly in to two groups using computer programs each included 100 participants and subjected to either NST or UAD study.

**Non stress test group:** Cardiotocography was used to perform non stress test in a semi setting position over a 20 minute period. Results are classified into reactive or non reactive according ACOG; ( 2005) previously mentioned <sup>(6)</sup>.

**Umbilical artery Doppler group:** A color flow mapping of umbilical artery was performed using computed sonography system (Medison X8- korea). UAD indices included resistant index (RI), pulsatility index (PI) and systolic/diastolic ratio(S/D ratio) were recorded for all participants using trans abdominal ultrasound. Abnormal levels were considered if RI > 0.70, PI > 0.99 or S/D ratio value >4.

### **Protocol of managements**

Patients with normal test results were discharged and followed up every two weeks until delivery. Patients with abnormal tests, the test was repeated after one week. According to the results of 2<sup>nd</sup> testing, patients with normal test results were discharged and followed up every two weeks until delivery and patients with abnormal test results, induction of labor was offered after induction of lung maturity by a single course of Dexamethason of 24 mg on two doses 12 hours apart.

### **Statistical analysis**

data in this study were analyzed using the statistical package of social science (SPSS 10 for windows, version II). Student's test (t-test) was used to check the significance between continuous data, Chi-square test ( $X^2$ ) Was used to check the significance between categorical data, the probability of significance P value < 0.05 was taken as a limit of statistical significance.

## Results

The mean age of participants was ( $29.19 \pm 3.12$  and  $29.17 \pm 3.15$  for NST and UAD groups respectively). The mean gestational age was ( $36.2 \pm 1.1$  vs.  $36.93 \pm 1.4$  respectively). The risk factors for the studied patients were DM, HTN, Polyhydraminos, Preeclampsia, Previous IUGR, PTL, anemia, placenta previa and history of CFMF. The distribution of these risk factors was similar between both groups with no statistically significant differences in either sociodemographic or risk factors ( $p > 0.05$ ).

**Table(1): Abnormal results of NST& UAD of both groups in the 1<sup>st</sup> and 2<sup>nd</sup> visits**

Result \ Test	NST Group	UAD Group	P value
1 <sup>st</sup> ANC visit	58 (58%)	28 (28%)	<b>0.000*</b>
2 <sup>nd</sup> ANC visit	22 (22%)	19 (19%)	<b>0.009*</b>
<b>P value</b>	<b>0.000*</b>	<b>0.000*</b>	

\*: Statistically significant

UAD: umbilical artery doppler

NST: non stress test.

**Table (2): Results of abnormal NST and abnormal UAD according to risk factors**

Risk factor	NST group	UAD group	P value
Diabetes mellitus	10/19	4/20	0.034*
Gestational hypertension	7/12	2/11	0.049*
Placenta previa	4/6	2/5	0.782
Polyhydraminos	2/4	3/7	0.819
Preeclampsia	9/12	4/15	0.013*
Previous IUGR	7/14	5/13	0.547
Prelabor rupture of membranes	6/10	3/10	0.369
Preterm labor	8/15	2/11	0.158
Anemia	3/5	1/4	0.708
History of congenital fetal malformations	2/3	2/4	0.659
<b>Total</b>	<b>58/100</b>	<b>28/100</b>	<b>0.000*</b>

\*: statistically significant

UAD: umbilical artery doppler

NST: non stress test

Table (3): Maternal outcomes of the studied groups

Outcome \ Group	Non stress test group		Umbilical artery doppler group		P
	(n=100)	%	(n=100)	%	
<b>Mode of delivery</b>					
Vaginal delivery	61	61%	73	73%	0.002
Cesarean section	39	39%	27	27%	
<b>Induction of labor for abnormal test results in 2nd visit</b>	<b>(n= 22)</b>	<b>%</b>	<b>(n= 19)</b>	<b>%</b>	
Successful induction	4	18.2	11	57.9	< 0.01
Failed induction	18	81.8	8	42.1	
<b>Indications of cesarean section</b>	<b>(n= 39)</b>	<b>%</b>	<b>(n= 27)</b>	<b>%</b>	
Fetal distress	18	46.2	8	29.7	0.02*
Breech	4	10.3	4	14.8	0.36
Previous cesarean section	10	25.6	9	33.3	0.44
≥ 2 cesarean sections	7	17.9	6	22.2	0.23

## Discussion

**In non stress test group:** It was found that the percentage of non reactive NST in the 1st ANC visit was 58%. When NST was repeated after one week 36 out of the 58 patients with non reactive test became reactive while only 22 patients remained non reactive so the percentage of non reactive NST had dropped from 58% to 22% and the difference was statistically very highly significant ( $p < 0.001$ ) (table 1). The difference in results between the two consecutive tests could be attributed to the presence of false positive results for NST. This finding is in agreements with *Neilson (1994)* and *Weiner et al, (1994)* who estimated false positive results of NST in different risk factors to vary from 35-65% and they concluded that NST should be performed at least twice to decrease these false positive results <sup>(8&9)</sup>. Also *Caroline et al, (2009)* found that non reactive NSTs have about 55% false positive rates (i.e., a backup test is normal) <sup>(10)</sup>.

**Table (4): Fetal outcomes of the studied groups**

Characteristics \ Test	NST Group		UAD Group		P value
<b>Gestational age( weeks) #</b>	37±1.2		37±1.7		0.6
<b>Mode of delivery</b>					
Vaginal delivery	61	61%	73	73%	0.002
Cesarean section	39	39%	27	27%	
<b>APGAR score</b>					
1-min APGAR score < 4	15	15.0	2	2.0	0.003
5-min APGAR score >7	85	85.0	98	98.0	
<b>State of admission to NICU</b>					
NO	85	85.0	98	98.0	0.006
YES	15	15.0	2	2.0	
<b>Cause of admission to NICU</b>					
Diabetes mellitus	6	40.0	1	50.0	0.08
Hypertension	2	13.3	1	50.0	0.03
Preeclampsia	5	33.3	--	--	--
Previous IUGR	2	13.3	--	--	--
<b>Gestational age at time of admission to NICU</b>					
<37 weeks	4	26.6	1	50.0	0.009
≥37 weeks	11	73.3	1	50.0	

values are given as no.% unless otherwise mentioned.

# Values given as mean ±SD .

**In umbilical artery Doppler group:** It was found that the percentage of abnormal UAD in the 1st ANC visit was 28%. When the test was repeated after one week 9 out of the 28 patients with abnormal test became normal while only 19 patients remained abnormal so the percentage of abnormal test had dropped from 28% to 9% and the difference was statistically very highly significant ( $p < 0.001$ ) (table 1). The difference in results between the two consecutive test results could be also attributed to the presence of false positive results for UAD.

In the 1<sup>st</sup> and 2<sup>nd</sup> ANC visits respectively , the incidence of abnormal test results was (58% vs. 28% and 22% vs. 19%) for NST and UAD groups respectively and the difference was statistically significant ( $p < 0.01$ ). These differences between abnormal test results in NST and UAD groups in 1<sup>st</sup> and 2<sup>nd</sup> visits could be attributed to higher false positive results of NST compared to UAD table (1).

The results of our study were found to be similar to *Divon et.al, (1989)* who reported in their study a higher false-positive rate for non stress test than umbilical artery Doppler (39% vs. 22%) , they concluded that repetition of non stress test is recommended to decrease the higher false positive results <sup>(11)</sup>. Also *Morris et al, (2011)* stated that in high-risk populations, fetal umbilical artery Doppler is a moderately useful test to predict mortality and risk of fetal compromise <sup>(12)</sup>. As a result of the presence of false positive results for the antenatal screening tests of fetal wellbeing, investigators recommend either repetition of NST <sup>(11)</sup> or in case of doppler studies the test is to be applied to multiple fetal vessels *Lakhkar et al, (2006)* to increase the sensitivity of these tests <sup>(13)</sup>.

When we compare the abnormal test results as regard to the risk factors we found that DM, gestational hypertension and preeclampsia were significantly higher in NST group compared to UAD group, meaning that these disorders have higher false positive results when NST is used. (table 2).

As regard to maternal outcomes, the rate of vaginal delivery was statistically higher in UAD group (73% vs. 61%  $p < 0.05$ ), while CS rates were statistically higher in NST group (39% vs. 27%  $p < 0.05$ ) (table 3). However these results were against the study done by *Williams et al, (2003)* who found that the rate of CS was similar in both groups (32.3% vs. 28.2  $p > 0.05$ ) <sup>(14)</sup>.

On the other hand when we analyze the indication of cesarean section in both groups we found that the only significant difference was for fetal distress. It was found that NST group was associated with higher CS rate for fetal distress than UAD group (46.2% vs. 29.7% respectively  $p = 0.02$ ) (table 3). This finding was in accordance with *Williams et al, (2003)* who found the rate of CS for fetal distress to be (27% vs. 16% for NST and UAD respectively  $p < 0.01$ ) <sup>(14)</sup>.



In the current study the rate of successful induction of labor was significantly higher in UAD group (57.9% vs.18.2%  $p<0.01$ ) (table 3). This result is in accordance with *Williams et al (2003)* who found that more patients in the Doppler group required an induction of labor than in NST group (4.8% versus 1.9% for UAD and NST respectively  $p<0.05$ )<sup>(14)</sup>. Finding of our study could be attributed to the fact that Doppler assessment identified a higher proportion of patients with early placental compromise than NST that allows successful induction of labor before the occurrence of placental decompensation. Concomitantly this increased rate of induction did not result in an increase in the overall rate of cesarean delivery. In addition, there was no increase in the rate of cesarean delivery for failure to progress in the Doppler group.

In the present study there is a significant difference in APGAR scores  $< 4$  at 1 minute (15% vs.2%) and APGAR score 5 minutes  $>7$  (85% vs. 98%) for NST and UAD groups respectively  $p=0.003$ . also the admission to neonatal intensive care unit (NICU) was higher for neonates of NST group than UAD group (15% vs. 2% respectively  $p=0.006$ ) table (4). these results were found to be similar to *Divon et.al, (198)* and *Williams et al, (2003)*<sup>(11&14)</sup>

### Conclusions and recommendations

The use of umbilical artery Doppler ultrasound assessment as an antenatal screening test in high risk pregnant population complaining of decreased fetal movement in upper egypt is associated with a reduction in the incidence of cesarean delivery for fetal distress, more successful induction of labor, less admissions to NICU and better APGAR score compared to non stress test.

We recommend the uses of umbilical artery Doppler study as a screening tool in high risk pregnancy affected by decreased fetal movement to decrease perinatal morbidity and mortality.

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**Conflicts of Interest:** authors of this article declare that they have no conflicts of interest.

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