Evaluation of fetal wellbeing in high risk pregnancy using compararative study between fetal biophysical profile alone and fetal biophysical profile incorporating middle cerebral to umbilical artery resistance index ratio

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رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَى وَالِدَيَّ وَ أَنْ أَعْمَلَ صَالِحاً تَرْضَاهُ وَ أَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ

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Abstract

A high-risk pregnancy is one in which the mother or fetus has a significantly increased chance of death or disability. High Risk pregnancy includes: Hypertensive disorders in pregnancy, Diabetes mellitus with pregnancy, postdate, Multifetal pregnancy, Rh isoimunization and IUGR.

The objectives of fetal surveillance for high risk patients are to determine the gestational age, fetal congenital anomalies, normal fetal growth and the severity of acute and chronic fetal asphyxia. methods used including: biochemical tests, fetal daily movement count, fetal biophysical profile, middle cerebral and umbilical artery Doppler. The aim of this study is to detect the accuracy of the middle cerebral to umbilical artery resistance index ratio in predicting foetal outcome in cases of high risk pregnancy.

Key words:

High risk pregnancy, fetal wellbeing, biophysical profile, umbilical artery Doppler, middle cerebral artery Doppler.

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List of abbreviations

AC	**:**	Abdominal circumference
ACOG	**:**	American College of Obstetricians and Gynecologists
AF	**:**	Amniotic fluid.
AFI	**:**	Amniotic fluid index.
AGA	**:**	Average for gestational age
BPM	**:**	Beat Per minute
BPP	**:**	Biophysical profile
C/U	**:**	Cerebral / Umbilical ratio
CNS	**:**	Central nervous system
CS	**:**	Cesarean section
CST	**:**	Contraction stress test
CTG	**:**	Cardiotocography
CW	**:**	Continuous wave
EDF	**:**	End diastolic flow
FHR	**:**	Fetal heart rate
FVW	**:**	Flow velocity waveform
IUGR	**:**	Intrauterine growth retardation
LGA	**:**	Large for Gestational Age
MCA	**:**	Middle Cerebral Artery
NST	**:**	Non stress test
PI	**:**	Pulsatility index
PIH	**:**	Pregnancy induced hypertension
PV	**:**	Probability value
PW	**:**	Pulsed wave
RI	**:**	Resistance index
S/D	**:**	Systole / Diastole ratio
SGA	**:**	Small for gestational age
UA	**:**	Umbilical artery

Introduction

The spectrum of perinatal compromise ranges from the extremes of death and debilitating major handicaps to minor, nearly imperceptable, functional or structural defects. The goal of any antenatal surveillance method is to detect fetal jeopardy and to initiate therapeutic intervention when possible at an early enough stage to avoid major sequelae.

Fetal biophysical profile scoring ***(Manning et al., 1980)*** offers a great advance in the management of high risk pregnancies. Fetal hypoxemia and acidemia results in a profound alteration in the central nervous system that regulates the fetal biophysical activities. Thus, the fetus responds to central hypoxemia by an alteration in its movements, tone, breathing and heart rate patterns. Fetal aortic body chemoreceptor responses to arterial hypoxemia create a second, and important, set of fetal adaptation manifested by a reduction in amniotic fluid production, impaired fetal growth (intrauterine growth retardation) and increased probability of neonatal complications ***(Chez RA et al., 1982).***

Although the biophysical profile score improved the positive predictive value for detection of perinatal death, it still has a high false positive rate (71.8%), giving the potential for unnecessary intervention and its associated maternal and neonatal morbidity. On the other hand, when abnormal biophysical profile test results are associated with fetal hypoxia, it may be too late to prevent serious perinatal morbidity or intrauterine fetal death. Thus a more reliable test of fetal surveillance remains elusive (***Baskett et al., 1984).***

In recent years, examination of umbilical and uteroplacental arterial waveforms by Doppler ultrasound has presented a new and exciting method of investigation in the management of pregnancy. It is relatively

inexpensive and technically easy to use. It is tempting to speculate that introduction of this technology into clinical practice will reduce perinatal morbidity ***(Newnham et al., 1991).***

Not only does Doppler umbilical velocimetry identify fetal jeopardy, but also it is found to antedate other tests of assessment of fetal wellbeing in recognition of fetal compromize. Because it has been suggested that velocity waveform change precede abnormal cardiotocography, this may indicate that Doppler ultrasound studies may be of value in predicting adverse outcome, thus aiding to select the optimum time at which intervention is advisable ***(Haddad et al., 1988 & Farmakides et al., 1988).***

Selective use of umbilical Doppler velocimetry in pregnancies "at fetal risk" may be of benefit in antenatal care by a reduction of perinatal mortality and especially late fetal mortality ***(Omtzigt et al., 1994).***

Serial Doppler ultrasonography in a severely growth retarded fetus revealed progressive reduction in pulsatility index of the middle cerebral artery, consistent with brain-sparing effect. At 29 week, one week before fetal death, the pulsatility index in the middle cerebral artery returned to normal values and became reversed the day before fetal death. This report suggests that reverse flow in the middle cerebral artery is one of the terminal hemodynamic events preceding fetal death (***Waldo et al., 1996).***

Maternal diabetes mellitus is not associated with abnormalities in Doppler indices of the placental or fetal circulations except in those cases complicated by preeclampsia or intra-uterine growth retardation ***(Salvesen et al., 1993).***

Aim of the work

The aim of this study is to detect the accuracy of addition of the middle cerebral to umbilical arteries' resistance index ratio to the biophysical profile in predicting foetal outcome in cases of high risk pregnancy.

High Risk Pregnancy

Identification of a high risk pregnancy: -

Definition:

A high-risk pregnancy is one in which the mother or fetus has a significantly increased chance of death or disability (***Manning et al., 1980***)

Predisposing Factors:

In order to achieve optimal perinatal outcome, all factors contributing to mortality and morbidity in a particular pregnancy must be identified and managed early.

The predisposing factors of high risk pregnancy include:

I- Socioeconomic factors.

II- Demographic Factors:

a- Maternal age. b- Maternal education.

III- Medical factors.

a- Hypertensive disorders in pregnancy.

b- Diabetes with pregnancy.

c- Heart disease with pregnancy.

d- Maternal pulmonary disease.

e- Renal disease.

High Risk pregnancy includes:

1- Hypertensive disorders in pregnancy.

2- Diabetes mellitus with pregnancy.

3- Multifetal pregnancy.

4- Rh isoimunization and nonimmunologic fetal hydrops.

5- IUGR (intra uterine growth retardation).

6- Recurrent still birth.

7- Recurrent I.U.F.D.

8- Postdate pregnancy.

9- Others:

a- Cardiac diseases with pregnancy.

b- Patients with recurrent poor obstetrical outcomes.

c- Blood diseases with pregnancy.

d- Auto immune diseases with pregnancy.

Objectives of fetal surveillance for high risk patients:

The objectives of antepartum surveillance in the high risk patient are.

1- To determine gestational age.

2- To discover fetal congenital anomalies.

3- To detect abnormalities in fetal growth.

4- To detect and determine the severity of acute and chronic fetal asphyxia.

The method used to achieve these goals includes:

a- Biochemical tests (estradiol, human placental lactogen), which are now obsolete and known to be unreliable.

b- Biophysical tests which includes.

1- Nonstress test (NST).

2- Contraction stress test (CST).

3- Fetal biophysical profile (BPP).

4- Vibroacoustic stimulation test (VAST).

5- Modified biophysical profile (MBPP).

6- Umbilical and uterine Doppler ultrasound.

7- Fetal daily movement count (FDMC).

8 - Percutaneous umbilical blood sampling (PUBS).

CHAPTER (1)

Hypertensive Disorders

In Pregnancy

Elevated blood pressure during pregnancy is a challenging clinical problem for which the approach to evaluation and treatment differs substantially from that employed in non-pregnant patients.

First, the diagnostic spectrum is broader since in addition to various forms of chronic hypertension, the patient may have a short-lived, pregnancy specific form of hypertension, i.e., preeclampsia. The latter disorder is accompanied by substantially greater maternal and fetal risks than in uncomplicated essential hypertension, a fact of central importance to clinical decision making***. (Barron et al., 1995).***

Preeclampsia/ eclampsia have been recognized as a clinical entity since the times of Hippocrates ***(Chesley et al., 1998).*** In ***1916, Zweifel*** first termed 'toxaemia' the disease of theories. Many of the causal theories attributed to preeclampsia / eclampsia described pathological features of the clinical presentation which are the result rather than the cause of the disease process ***(Chesley, et al., 1998).*** It has been called many things and has been thought to be a neurological, renal, hepatic, hypertensive and more recently a placental disorder. The truth is that it is probably all these things in different people and is certainly more than just hypertension in pregnancy ***(Roberts and Redman, 1993).*** Several lines of evidence implicate endothelial cell injury as a basic pathogenic mechanism in preeclampsia resulting in impaired synthesis of vasodilators and a possible increase in the production of vasoconstrictors ***(Roberts et al., 1993).***