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ROLE OF DOPPLER ASSESSMENT OF THE CEREBROPLACENTAL RATIO IN THE PREDICTION OF FETAL AND NEONATAL OUTCOME IN HIGH RISK PREGNANCY

Thesis submitted for partial fullfillment of master degree in gynecology and obstetrics

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LIST OF ABBREVIATIONS

AEDF	Absent End diastolic flow
AFV:	Amniotic fluid volume
AFI:	Amniotic fluid index
AGA:	Appropriate for Gestational age
BPD:	Biparietal Diameter
BPPS:	Biophysical profile scoring
CPR:	Cerebroplacental ration
CST:	Contraction stress test syn. **OCT:** Oxytocin challeget
CTC:	Cardiotocography
EFW:	Estimated fetal weight
FBM:	Fetal Breathing movements
FHR:	Fetal Heat rate
FL:	Femur length
FM:	Fetal movements
FT:	Fetal tone
FVW:	Flow velocity waveform
IUGR:	Intrauterine Growth retardation
IVH:	Intraventricular haemorrhage
LGA:	Large for Gestational age
MCAPI:	Middle cerebral artery pulsatility index
NICU:	Neonatal intensive care unit
PI:	Pulsatility index
PNMR:	Perinatal Mortality rate
RDS:	Respiratory distress syndrome
RI:	Resistance index
S/D:	$\frac{\text{Systolic}}{\text{Diastolic}}$ ratio
SGA:	Small for Gestational age

Introduction

In the past, the method selected for antepartum fetal surveillance in high risk pregnancy conditions and the frequency of testing have been determined using an arbitrary criteria. Fitting such an arbitrary model to the spectrum of fetal diseases and their progression has never been satisfactory ***(Manning, 1999).*** Similarly, the application of one testing modality, to all fetal diseases (e.g antepartum fetal CTG) is not satisfactory Because Assessment of other biophysical markers of impending fetal trouble may yield superior information ***(phelan et al, 1985, Johnson et al, 1986).***

The object of any method of antepartum fetal surveillance is to identify that point in the natural progression of a perinatal disease process at which the risks attendant with continued fetal existence exceed those of delivery and neonatal life. At the same time the surveillance method should discriminate the fetus who is not at immediate risk even in the presence of risk factors in the mother permitting selective conservative management there by avoiding potential maternal and perinatal iatrogenic complications ***(Manning, 1999).***

The fetal biophysical profile score (BPPS) is a method of fetal risk surveillance based on a composite assessment of both acute and chronic markers of fetal disease. The relationship between test scores and perinatal outcome is complex arguing for gathering as many bits of data as possible to arrive at an accurate estimate of fetal risk. Therefore it is speculated that the addition of newer modalities of fetal assessment such as Doppler areterial velocimetry and Antepartum fetal Blood gas determination to the existing method of fetal BPPS will help to define the critical point of intervention ***(Manning, 1999).***

Doppler velocimetry studies were introduced in 1980s and it was expected that this technology could complement and eventually, replace existing methods of fetal surveillance. Many studies are being done to evaluate the values of study of specific fetal circulations. For example the umbilical artery Doppler velocimetry is now regarded as a primary test of placental function which was histologically proved to reflect placental vascular insufficiency without due effects on the fetus ***(Trudinger et al, 1991).***

Studies on fetal cerebral circulation has led to the development of new Doppler index that is the cerebroplacental ratio defined as the pulsatility index of middle cerebral artery divided by the pulsatility index of the umbilical artery. This ratio may be the most-sensitive Duplex index for prediction of outcome in fetuses with intrauterine growth retardation ***(Arbeille etal 1987, Gramellini 1992, Arduini 1992).***

Aim of the Work

The aim of this study is to determine the screening efficiency and accuracy of the umbilical artrery, middle cerebral artrery pulsatility indices and cerebro placental ratio in the prediction of fetal and neonatal morbidity and whether these tests are additive to fetal BPP in risk assessment and decision for timing of intervention in high risk pregnancy

Chapter 1

Basic Principles of Doppler Ultrasound

Introduction

Ultrasound is a sound with frequencies above the audible range. Diagnostic ultrasound uses frequencies of (2-10) MHz.

As a beam of ultrasound travels through human tissue it is reflected or scattered at tissue interfaces because of the heterogeneous nature of each tissue. Some of the back scattered echoes are detected by a receiving transducer and a computer then reconstructs these into a picture ***(pearce,1990)*** .

The idea of Doppler ultrasound depends on basic physical phenomenon called Doppler frequency shift which was first described by ***Johann Christian Doppler***, an Austrian mathematician and physicist in 1843 This phenomenon describes the perceived changes in the frequency of propagating energy waves consequent to any motion between the source of energy emission and an observer. When the source and the observer move apart the perceived frequency decreases. When the source and the observer move closer the frequency increases.

These changes will occur irrespective of whether the source and the observer moves.

Moreover, the magnitude of the changes in the frequency is proportional to the velocity of the movement of the source or the observer ***(Doppler, 1842), (White et al 1982)***.

In accordance with Doppler shift principle echoes returning from a moving structures are altered in frequency and the amount of shift is directly proportional to the velocity of the moving structures. The frequency of echoes returning from structures moving toward the transducer are higher than the frequency originally transmitted by the transducer. Conversely,