# DOPPLER STUDY, CARDIOTOCOGRAPHY AND BIOPHYSICAL PROFILE IN GROWTH RESTRICTED FETUSES

*THESIS*

*Submitted in completing fulfillment of*

*M.D. in*

**Obstetrics and Gynaecology**

*BY*


***Mona Fouad Ahmed Ismail***

*Assistant Lecturer of Obstetrics and Gynaecology*

*Faculty of Medicine – Cairo University*


*SUPERVISED BY*


Prof. Dr.: ***OMAIMA ABDEL-FATTAH IDRIS***

*Professor of Obstetrics and Gynaecology*

*Faculty of Medicine – Cairo University*

Prof. Dr.: ***ALAA NAGEEB AL-EBRASHI***

*Professor of Obstetrics and Gynaecology*

*Faculty of Medicine – Cairo University*

Lecturer Dr.: ***AHMED MOHAMED MAGED***

*Lecturer of Obstetrics and Gynaecology*

*Faculty of Medicine – Cairo University*



**Faculty of Medicine**
**Cairo University**
**2009**

# دراسة الدوبلر وقياس نبض الجنين
# و القياسات البيوفيزيائية
# في الأجنة المحدودة النمو

*مقدمة توطئة للحصول على درجة الدكتوراة من الطبيبة*


***منى فؤاد أحمد إسماعيل***

**مدرس مساعد أمراض النساء و التوليد**

**كلية الطب – جامعة القاهرة**


*تحت اشراف*


**ا.د. /*أميمة عبد الفتاح إدريس***

**أستاذ أمراض النساء و التوليد**

**كلية الطب – جامعة القاهرة**

**ا.د./ *علاء نجيب الإبراشي***

**أستاذ أمراض النساء و التوليد**

**كلية الطب – جامعة القاهرة**

**د./*أحمد محمد ماجد***

**مدرس أمراض النساء و التوليد**

**كلية الطب – جامعة القاهرة**



**كلية الطب- جامعة القاهرة**

**٢٠٠٩**

# INTRODUCTION

Intrauterine growth restriction (IUGR) is a syndrome, characterized by failure of the fetus to attain its normal growth potentials; fetuses with IUGR, therefore represent a subset of fetuses designated small for gestational age (SGA). The term SGA describes a group of neonates with a birth weight below the $10^{th}$ percentile. ***(Karsdorp et al., 1994).***

This term doesn't distinguish between constitutionally small infants and growth delay due to underlying pathology. Underlying pathologies for IUGR include aneuploidy, non aneuploid syndromes, viral infections and associated fetal anomalies where outcomes are not altered by intervention. In contrast, placental dysfunction causes growth restriction in otherwise normal fetuses. These fetuses are at risk of progressive metabolic deterioration, with manifestations in almost any organ system, leading to adverse fetal and neonatal outcome. ***( Baschat et al., 2000 and Bilardo et al., 2004).***

Because no therapy at present has been shown to significantly improve placental function, the goal of prenatal testing in such cases is to optimize the timing of delivery, late enough to avoid the sequel of iatrogenic severe prematurity, yet early enough to avoid fetal death. ***(Cohn et al., 1974).***

Doppler ultrasonography, CTG and biophysical profile scoring (BPP) are the principal surveillance tools in pregnancies complicated by placental vascular insufficiency and fetal growth restriction (IUGR). These antenatal testing modalities aim to detect fetal compromise by evaluating fetal manifestations of altered oxygenation and metabolic status. Fetal cardiovascular responses are a prominent feature of this form of growth restriction and their assessment reflects disease severity. As placental blood flow resistance worsens, changes in descending aortic and cerebral blood flow resistance are observed in the compensated state. Finally deteriorations in venous Doppler parameters are observed and reflect alterations in cardiac

forward function in response to advanced placental insufficiency. ***(Ferrazzi et al., 2002).***

Multi-vessel Doppler examination is able to accurately depict this progression in IUGR fetuses. Dynamic fetal variables (movement, tone, breathing and amniotic fluid volume) utilized for BPP and heart rate reactivity remain normal longer in the progression of IUGR Fetuses. ***(Baschat et al., 2001).***

With progressive fetal compromise reduction of global fetal activity is followed by a decline in fetal heart rate reactivity, fetal breathing movement and amniotic fluid volume. ***(Ribbert et al., 1993).***

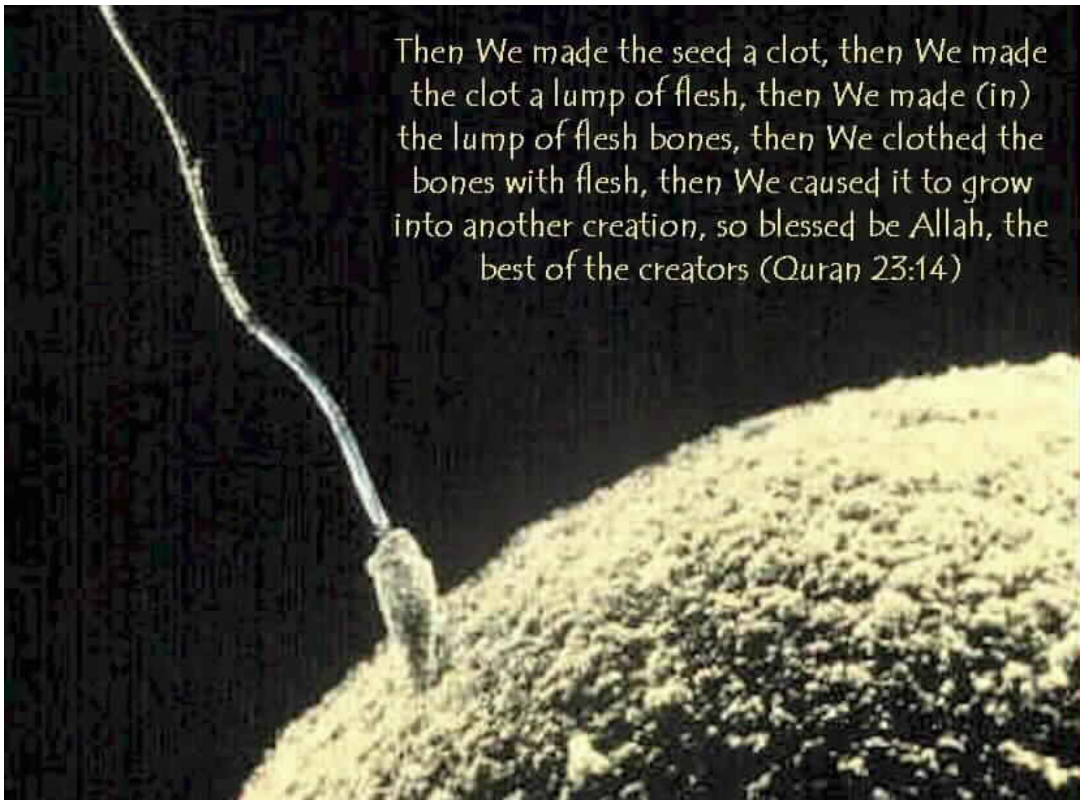
Finally, fetal tone and movements are lost in response to worsening acidemia. The BPP provides a good correlation with fetal acid-base status throughout the second half of pregnancy. ***(Manning et al., 1993).***

==========

# Aim of the Work

*The aim of the work was to determine the distribution and relationship of arterial and venous Doppler, BPP and CTG test results in a population of IUGR fetuses with placental insufficiency and to correlate these results with umbilical artery PH at birth in IUGR fetuses to guide timing of delivery in these fetuses.*

==========




**"ثم جعلنا النطفة علقة فخلقنا العلقة مضغة فخلقنا المضغة عظاما فكسونا العظام لحما ثم أنشأناه خلقا آخر فتبارك الله أحسن الخالقين"**

سورة المؤمنون آية ١٤

# ACKNOWLEDGEMENT

Before and above all, thanks to ALLAH who helped me to finish this work

I would like to dedicate all my success to the soul of one of the greatest persons in my life, **my father**. Thanks to **my mother** for her support and encouragement.

I would like to express my sincere gratitude to Prof. **OMAIMA ABDEL FATTAH IDRIS,** Professor of Obstetrics and Gynecology, Faculty of Medicine, Cairo University for her great support, encouragement, help, kindness, and advice throughout this work. It was a great honor for me to work under her guidance and supervision.

I would like to express my thanks to Prof. **ALAA NAGEEB AL-EBRASHY,** Professor of Obstetrics and Gynecology, Faculty of Medicine, Cairo University for his valuable criticism, fruitful advice, reassurance, help and assistance in performing this work.

Words can never express my thanks to Dr. **AHMED MOHAMED MAGED**, Lecturer of Obstetrics and Gynecology, Faculty of Medicine, Cairo University for his valuable help, advice, continuous guidance, assistance, encouragement and help without which it could not have been accomplished.

And Finally I would thank **my family** for their help, patience, support and love that gave me the strength to complete this work.

MONA FOUAD AHMED
2009

# LIST OF CONTENT

# LIST OF TABLES

**Page**

# LIST OF FIGURES

**Page**

***Page***



==========

# LIST OF ABBREVIATIONS

| | |
|---|---|
| **AC** | Abdominal Circumference |
| **AEDF** | Absent End Diastolic Flow |
| **AFV** | Amniotic Fluid Volume |
| **BMI** | Body Mass Index |
| **BPD** | Bi-Parietal Diameter |
| **BPM** | Beats Per Minute |
| **BPP** | Biophysical Profile |
| **CNS** | Central Nervous System |
| **CRL** | Crown Rump Length |
| **CST** | Contraction Stress Test |
| **CTG** | Cardiotocography |
| **CVS** | Cardiovascular System |
| **DV** | Ductus Venosus |
| **ECG** | Electrocardiograph |
| **EFW** | Estimated Fetal Weight |
| **FAA** | Fetal Abdominal Area |
| **FGR** | Fetal Growth Restriction. |
| **FHR** | Fetal Heart Rate |
| **FL** | Femur Length |
| **FVW** | Flow Velocity Waveform |
| **GIT** | Gastointestinal Tract |
| **GTT** | Glucose Tolerance Test |
| **GUT** | Genitourinary Tract |
| **HC** | Head Circumference |
| **IUGR** | Intrauterine Growth Restriction |
| **L/S** | Lecithin Sphingomyelin Ratio |
| **LBW** | Low Birth Weight |
| **MCA** | Middle Cerebral Artery |
| **NST** | Non-Stress Test |
| **PI** | Ponderal Index |
| **PI** | Pulsatility Index |
| **REDF** | Reversed End Diastolic Flow |
| **RI** | Resistance Index |
| **SFH** | Symphyseal Fundal Height |
| **SGA** | Small For Gestational Age. |
| **UA** | Umbilical Artery |
| **UPI** | Utero-placental insufficiency |
| **WHO** | World Health Organization |

# ABSTRACT

BACKGROUND:

*Multi-vessel Doppler ultrasonograph, cardiotococraphy and biophysical profile scoring are the principal surveillance tools in pregnancies complicated by fetal growth restriction. The interpretation of these tests done concurrently may be complex.*

OBJECTIVE:

*This study examines the relationship between arterial and venous Doppler, BPP and CTG results in IUGR fetuses and correlates their abnormalities with umbilical artery PH at birth to guide timing of delivery of these fetuses.*

DESIGN:

*Prospective observational study.*

SETTING:

*Fetal Medicine Unit, Department of Obstetrics and Gynecology-Cairo University Hospitals-Kasr El Aini.*

PATIENTS and METHODS:

*50 patients diagnosed with intrauterine growth restriction (IUGR); all patients underwent uniform antenatal assessment protocol that includes a four component biophysical profile score, cardiotocography and umbilical artery (UA), middle cerebral artery (MCA) and ductus venosus (DV) Doppler ultrasound studies.*

*All patient were delivered by caesarean section. Samples were obtained from the umbilical cord for cord artery PH. Apgar scores at 1 and 5 minutes were recorded.*

OUTCOME:

*Correlation of Doppler results, BPP, CTG and cord blood PH were analyzed.*

RESULTS:

*There was no significant decrease in GA at time of termination in cases of IUGR with abnormal DV-PIV compared to those with only abnormal UA-PI and MCA PI. Abnormal UA-Doppler was found in 19 patients (38%); 16 of them showed high PI (32%), 2 showed absent end*

*diastolic flow (4%) and 1 showed reversed diastolic flow (2%). Abnormal MCA Doppler was found in 8 patients (16%) and abnormal DV Doppler was found in 9 patients (18%). The Abnormal DV Doppler was significantly related to poor outcome parameter; pH < 7.20, low Apgar at 5-min and perinatal mortality; when compared with either Abnormal MCA or UA Doppler (p< 0.05). While there was no significant difference between MCA and UA Doppler abnormalities in detecting poor outcome (p> 0.05). BPP was normal in 33 patients (66%), equivalent in 9 patients (18%) and abnormal in 8 patient (16%). The Abnormal and equivalent BPP were significantly related to poor outcome parameter; pH < 7.20, low Apgar at 5-min and perinatal mortality; when compared with normal BPP. (p< 0.05). CTG was reactive in 31 patients (62%), non reactive in 10 patients (20%) and showed loss of variability in 9 patients (18%). Loss of variability and non reactive CTG were significantly related to early GA at delivery, poor Apgar score at 1 and 5 min when compared with reactive CTG (p<0.05). But these were of no significance in detecting PH < 7.2 (p>0.05).*

CONCLUSION:

*The conclusion of our study is that there is an important association between DV abnormalities and adverse neonatal outcomes suggesting that the assessment of this vessel is important to determine the timing of delivery especially premature as once DV-PIV is elevated 2 SD above the mean delivery is indicated provided that the fetus has a good chance of postnatal survival. We concluded also that multi-vessel Doppler ultrasonography, CTG and BPP can effectively stratify IUGR fetuses with placental vascular insufficiency into risk categories. When applied together, the pattern of results is not perfectly consistent. Fetal deterioration appears to be independently reflected in these testing modalities: their combined use is likely to be complementary.*

Keywords:

*Doppler ultrasonography – Cardiotococraphy - Biophysical profile - Fetal growth restriction.*