

Prenatal Duplex study in neonates with Intrauterine Growth Restriction (IUGR)

Thesis

*Submitted for partial fulfillment of the master degree In
Pediatrics*

By:

Perwin Aly Mohamed Aly Waly
(M. B., B.Ch)

Supervised by

Prof. Nancy Abd El-Aziz Soliman

*Professor of Pediatrics
Faculty of Medicine
Ain Shams University*

Prof. Saied Mohamed Tohamy

*Professor of Obstetrics & Gynecology
Faculty of Medicine
Ain Shams University*

Dr. Iman Ali Abd El-Hamid

*Lecturer in Pediatrics
Faculty of Medicine
Ain Shams University*

**Faculty of Medicine
Ain Shams University**

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا
عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

سورة البقرة آية (٣٢)



Acknowledgement

*First and foremost, thanks to **Allah** for giving me the will and the patience to finish this work,*

*In a few grateful words, I would like to express my deepest gratitude and appreciation to **Prof. Dr. Nancy Abd El-Aziz Soliman**, Professor of Pediatrics Faculty of Medicine-Ain Shams University, and **Prof. Saied Mohamed Tohamy** Professor of Obstetric and Gynecology faculty of Medicine –Ain Shams University for their great concern and generous help .Without their generous help, this work would not have been accomplished in its present picture.*

*I am sincerely grateful to **Dr. Iman Ali Abd El- Hamid** Lecturer of Pediatrics, Faculty of medicine, Ain Shams University, for her kind help and constructive suggestions to achieve this work,*

*I would also like to express my deep appreciation to **The Perinatal Care Unit Team** Obstetric and gynecology hospital - Ain Shams University, for their great kindness, constant assistance and guidance.*

*There are no words to express my gratitude to **my family** who charged me with love and encouragement*

*And lastly my best friend and colleague who supported me **Dina Gareer Ramadan** and to all patients and their families for their participation in this study.*



Perwin Aly Waly

Contents

List of Abbreviations	i
List of Tables	v
List of Figures	vii
Introduction and Aim of the work	١
* Normal fetal growth	٤
* Fetal growth disorders	٢٠
* Historical review on ultrasonography	٣٠
* Doppler ultrasound	٣٧
* Prediction of small or growth restricted fetus	٥٣
Subjects and Methods	٨٠
Results	٨٦
Discussion	١٠٣
Summary and Conclusion	١١٢
Recommendations	١١٥
References	١١٦
Arabic Summary	--

List of Abbreviations

A	: The Time Average Velocity
AC	: Abdominal Circumference
ACOG	: American College of Obstetric and Gynecology
AEDV	: Absent End Diastolic Volume
AFV	: Amniotic Fluid Volume
B-mode	: Brightness Modulation
BPD	: Biparital Diameter
C	: Speed of Sound in Tissue
C.S	: Ceserian Section
Cm	: Centimeter
Cm ²	: Square Centimeter
Cms	: Centimeters
Cos	: Cosine
CVS	: Cardio-Vascular System
CW	: Continuous Wave Doppler
Cycle/S	: Cycle / Second
D	: Diameter
D	: The End-Diastolic Frequency Shift
DI	: Doppler Index
e.g.	: Example
EDD	: Expected Date of Delivery
EFW	: Estimated Fetal Weight
F	: Female
F/A	: Femur-to-Abdomen Ratio
FAC	: Fetal Abdominal Circumference:
FAS	: Fetal Alcohol Syndrome
FD	: Doppler Shift
FDA	: Fetal Descending Thoracic Aorta Artery
FDA-PI	: Fetal Descending Thoracic Aorta Artery Pulsatility Index

List of Abbreviations (Cont.)

FDA-RI	:	Fetal Descending Thoracic Aorta Artery Resistance Index
FGR	:	Fetal Growth Restriction
Fig	:	Figure
FL	:	Femur length
F-ratio	:	Fisher's Ratio
Ft	:	Transmitted Beam
FWV	:	Flow Velocity Waveforms
GA	:	Gestational Age
GA-Ballard	:	Gestational Age by Ballard Score
GA-Date	:	Gestational Age by Dates
GA-US	:	Gestational Age by Ultrasound
GH	:	Growth Hormone
Gms	:	Grams
Grps	:	Groups
Gyn	:	Gynecology
HC	:	Head Circumference
HS	:	Highly Significant
Hypogly	:	Hypoglycemic
HZ	:	Hertz
i.e.	:	Example
I.V fluids	:	Intravenous Fluids
IBM	:	International Business Machines Corporation
IGF	:	Insulin like Growth Factor
IGFBP	:	Insulin like Growth Factor Binding Protein
IQ	:	Intelligence Quotient
IUGR	:	Intra Uterine Growth Restriction
IV_he	:	Intraventricular Hemorrhage
JOCG	:	Journal of Obstetric and Gynecology in Canada
Kgs	:	Kilograms
KHZ	:	Kilo-Hertz

List of Abbreviations (Cont.)

Log	: Logarithm
LSCS	: Lower Segment Cesarean Section
M	: Is an expression of unknown factors
M	: Male
Max	: Maximum
MCA	: Middle Cerebral Artery
MCA-RI	: Middle Cerebral Artery Resistance Index
MHZ	: Mega - Hertz
Min	: Minute
Min.	: Minimum
M-mode	: Motion Modulation
Mode-Del	: Mode of Delivery
mW	: Milli - Watt
NEC	: Necrotizing Entero-Colitis
Need-Adm	: Need for Admission
Neg	: Negative
Neuro-Exam:	Neurological Examination
NICU	: Neonatal Intensive Care Unit
No.	: Number
NS	: Non Significant
Ob	: Obstetric
P	: Probability of Error
PAPP-A	: Pregnancy Associated Plasma Protein A
Perivent-Leukomalacia:	Periventricular Leukomalacia
PI	: Pulsatility Index
PIH	: Pregnancy Induced Hypertension
Pos	: Positive
Prev-IUGR	: Previous Intra Uterine Growth Restriction
Pulm-He	: Pulmonary Hemorrhage
PW	: Pulsed Wave Doppler

List of Abbreviations (Cont.)

Q	: Angle
RCOG	: Royal College of Obstetric and Gynecology
REDV	: Reversed End Diastolic Velocity
REDV	: Reversed End Diastolic Volume
Reg Coefficient:	Regression Coefficient
Resp-Supp	: Respiratory Support
RI	: Resistance Index
S	: Peak Systolic Frequency Shift
SD	: Standard Deviation
SFH	: Symphyseal Fundal Height
SGA	: Small for Gestational Age
Sig.	: Significant
SPSS	: Statistical Product and Service Solutions
TCD	: Transverse Cerebellar Diameter
Tol-Feeding:	Tolerance of Feeding
TORCH	: Toxoplasmosis, Rubella, Cytomegalovirus, and Herpes Simplex
U/S	: Ultrasound
UA	: Umbilical Artery
UA-RI	: Umbilical Artery Resistance Index
USA	: United States of America
Ut-A-RI	: Uterine Artery Resistance Index
V	: Flow Velocity
V.	: Version
VD	: Vaginal Delivery
VLBW	: Very Low Birth Weight
Wt-Del	: Weight on Delivery
Wt-US	: Weight by Ultrasound
X	: Is the dimension concerned. Here it is FAC.
Y	: Is the fetal volume or weight (since the fetal density is virtually one).

List of tables

<i>Table</i>	<i>Title</i>	<i>Page</i>
١	The percentile values of birth weight according to the maternal parity and fetal sex	٨
٢	Corrections (gm) to added or subtracted from the birth weight in accordance with maternal height and weight at midpregnancy	٩
٣	Relationship between the fetal abdominal circumference (FAC) measurements from ٢١ to ٤٠cm and birth weight centiles (in gm).	٦٢
٤	the descriptive statistics of the Normal Doppler group	٨٦
٥	the descriptive statistics of the Abnormal Doppler group	٨٨
٦	Comparison between both groups regarding gender of the baby	٩٠
٧	Comparison between both groups regarding delivery of previous IUGR neonate	٩١
٨	Comparison between both groups regarding need of admission	٩٢
٩	Comparison between both groups regarding mortality	٩٣
١٠	Comparison between both groups regarding neurological examination	٩٤
١١	Comparison between both groups regarding occurrence of intraventricular hemorrhage	٩٥

List of tables (Cont.)

<i>Table</i>	<i>Title</i>	<i>Page</i>
١٢	Comparison between both groups regarding occurrence of periventricular leukomalacia	٩٦
١٣	Comparison between both groups regarding pulmonary hemorrhage	٩٧
١٤	Comparison between both groups regarding need to respiratory support	٩٨
١٥	Comparison between both groups regarding NEC occurrence	٩٩
١٦	Comparison between both groups regarding tolerance of feeding	٩٩
١٧	Comparison between both groups regarding neonatal hypoglycemia	١٠٠
١٨	Comparison between both groups regarding mode of delivery	١٠١
١٩	Stepwise multi-regression analysis between UA RI and FDA PI	١٠٢
٢٠	Stepwise multi-regression analysis between UA RI and MCA RI	١٠٢

List of Figures

Fig.	Title	Page
၁	Lubchenco growth curve	၆
၂	Neligan growth Curve	၆
၃	Thomson growth curve	၇
၄	Brenner growth curve	၇
၅	Growth Chart ၂၀၀၃	၁၀
၆	IUGR infant (left), normally grown, non-IUGR infant (right)	၂၁
၇	placental damage causing IUGR	၂၄
၈	Christian Johann Doppler	၃၇
၉	Ultrasound velocity measurement. The diagram shows a scatterer S moving at velocity V with a beam/flow angle θ	၃၉
၁၀	Doppler ultrasound	၄၀
၁၁	Continuous wave Doppler transducer	၄၄
၁၂	Pulsed-wave Doppler transducer	၄၄
၁၃	Setting up the sample volume.	၄၈
၁၄	Effect of the Doppler angle in the sonogram.	၅၁
၁၅	The relation between the fetal abdominal circumference (FAC) value (± 2 SD, ± 1 SD and mean) and the birth weight	၆၃
၁၆	The ± 2 SD (standard deviation) range of the FAC and the fetal maturity	၆၅
၁၇	Ultrasound image with color Doppler showing the umbilical cord, red umbilical artery and blue umbilical vein (left). Normal flow velocity waveforms from	၆၉

	umbilical vein (bottom) and artery (top) at weeks of gestation (right)	
۱۸	Abnormal Development of the umbilical artery	۷۱

-Vii-

List of Figures (Cont.)

<i>Fig.</i>	<i>Title</i>	<i>Page</i>
۱۹	Color Doppler examination of the circle of Willis (left). Flow velocity waveforms from the middle cerebral artery in a normal fetus with low diastolic velocities (right, top) and in a growth-restricted fetus with high diastolic velocities (right, bottom).	۷۳
۲۰	Abnormal Development of the uterine artery	۷۶
۲۱	Color Doppler examination of the descending thoracic aorta (left) with normal flow velocity waveforms showing positive flow velocities during diastole (right, top) and in a growth-restricted fetus with reversed end-diastolic velocities (right, bottom).	۷۸
۲۲	Gender of the baby in both groups	۹۰
۲۳	Delivery of previous IUGR neonate in both groups	۹۱
۲۴	Need of admission in both groups	۹۲
۲۵	Neurological examination of the neonates in both groups	۹۳
۲۶	Occurrence of intraventricular hemorrhage in both groups	۹۵
۲۷	Occurrence of periventricular leukomalacia in both groups	۹۶

-Viii-

List of Figures (Cont.)

<i>Fig.</i>	<i>Title</i>	<i>Page</i>
٢٨	Pulmonary hemorrhage in both groups	٩٧
٢٩	Need of respiratory support in both groups	٩٨
٣٠	NEC , tolerance of feeding and neonatal hypoglycemia in both groups	١٠٠
٣١	Mode of delivery in both groups	١٠١

