The value of 3D power Doppler study of placental vasculature and volume versus Doppler indices in patients at risk of placental insufficiency and their relation to neonatal outcome and placental pathology

A thesis

Submitted for partial fulfillment of

M.D. degree in Obstetrics and Gynecology

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2015

Abstract

Methodology: The present study was conducted upon 100 pregnant women at risk of placental insufficiency, with the aim to reveal the the value of 3D power doppler (3DPD) in assessment of placental vasculature in relation to Doppler indices and correlation of both with neonatal outcome and placental histopathology.

Results: Placental blood flow perfusion in patients with affection of fetal doppler (IUGR, severe preeclampsia and antiphospholipid syndrome) had a lower VI, FI, VFI compared to patients with normal fetal doppler. This difference was statistically highly significant ($P<0.001$).

Also there was inverse correlation between RI umbilical and VI, FI, and VFI and direct correlation between RI MCA, placental weight, placental volume, and birth weight with VI, FI, and VFI

Conclusion: 3DPD indices of placental bed vasularity revealed a significant change of placental vasculature before reflrction on fetal doppler. 3DPD ultrasound may be an important modality in future placental research and in the evaluation of feto-placental insufficiency in clinical practice.

Key words:

Three dimensional power Doppler (3DPD), placental insufficiency, doppler indices, placental pathology, neonatal out come.

Acknowledgement

My sincere thanks and deep appreciation are offered to my **Prof. Dr. Mostafa Abdelhamid Seleem,** Professor of Obstetrics and Gynecology, Faculty of medicine, Cairo University for his kind guidance, keen supervision and encouragement.

My extreme appreciation to **Prof.Dr.Hazem Salaheldin Alashmawy,** Assistant Professor of Obstetrics and Gynecology, Faculty of Medicine Cairo University, for his support, help, generous guidance and supervision

I wish I could properly express my sincere gratitude to Dr**.** A**hmed Abdelmagid Abdallah,** Lecturer of Obstetrics and Gynecology, Faculty of medicine, Cairo University, and Dr. **Mohamed faisal Ibrahim,** Lecturer of pathology, Faculty of medicine, Cairo University, for their invaluable help, great support and their patience with me until this work has been completed.

A huge bunch of flowers are offered to the soul of my dearest mother, who was always loving, giving and caring.

Finally, I would like to thank my family and my wife for their encouragement and patience.

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List of Abbreviations

2DUS	Two dimensional ultrasound
3DPD	Three Dimensional power Doppler.
3DUS	Three dimensional ultrasound
Ab	antibody
ACOG	American College of Obstetricians and Gynecologists.
AEDF	Absent end diastolic flow
AFI	Amniotic fluid index.
APS	Antiphospholipid syndrome
ACL	anticardiolipin
BPP	Biophysical profile.
BP	Blood pressure
CBC	Complete blood count.
CPR	Cerebroplacental ratio
CRL	Crown–rump length.
CU	Cerebral/umbilical
CW	Continous wave
FGR	Fetal growth restriction.
FI	Flow Index.
HLA	Human leucocytic antigen
HELLP	Hemolysis, elevated liver enzyme, low platelets
IUGR	Intrauterine growth restriction

LAC	Lupus anticoagulant.
NHBPEP	National High Blood Pressure Education Program.
NO	Nitric oxide
PI	Pulsatility index.
PV	Placental volume.
PW	Pulsed wave.
REDF	Reversed end-diastolic flow.
RI	Resistance index.
S/D	Systolic/ Diastolic Ratio.
VFI	Vascularization Flow Index.
VI	Vascularization Index.
VOCAL	Virtual organ computer-aided analysis.

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Introduction

Placental insufficiency, whether primary or secondary to maternal factors such as hypertension and poor nutrition is the most common cause of intrauterine growth retardation (IUGR), which is an important obstetric problem on account of the high associated perinatal mortality and morbidity. It is essential to recognize placental insufficiency early so that its hazards can be reduced, if not prevented (**Shahina et al., 2010**).

Doppler examinations of intraplacental blood circulation appear to be an efficient method for diagnosing and managing pregnancies complicated by fetal intrauterine growth restriction (IUGR), especially because the changes in maternal Doppler findings (i.e., uterine artery) and in fetal Doppler (i.e., umbilical artery) are secondary to the changes in the placental vascular tree (**Abramowicz et al.,2008).**

The umbilical artery was the first fetal vessel to be evaluated by Doppler velocimetry, and since then became the most widely investigated component of the fetal circulation as it is readily accessible to Doppler interrogation and also it is a vital component of fetal circulation acting as a lifeline between fetus and the placenta **(Maulik 2005)**.

Thanks to great technological progress over the last few years, it is now possible to quantitatively evaluate intraplacental blood circulation and placental volume by means of 3D Power Doppler and VOCAL technique. Intraplacental blood circulation is described by three vascular indices: vascularization index (VI), flow index (FI), and vascularization flow index (VFI). Vascularization index is the ratio of the number of color voxels to the total number of voxels in the sampled tissue, thus it represents the percentage of vascularized tissue .Flow index is the average color value of all color voxels and it describes the mean velocity