

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

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Abstract

Methodology: The present study was conducted upon 100 pregnant women at risk of placental insufficiency, with the aim to reveal 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 reflection 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 outcome.

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List of Abbreviations

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

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