

## Research Article

# Placental Volume and Three-Dimensional Power Doppler Analysis in Prediction of Pre-Eclampsia and Small for Gestational Age

Hayam FM<sup>1\*</sup>, Nossair WS<sup>2</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, Ain Shams University, Egypt

<sup>2</sup>Department of Obstetrics and Gynecology, Faculty of Medicine, Zagazig University, Egypt

\*Corresponding author: Hayam FM, Department of Obstetrics and Gynecology, Ain Shams University, Egypt. Tel: +201001574386; Email: mohammedelsokary1@yahoo.com

**Citation:** Hayam FM, Nossair WS (2017) Placental volume and three-dimensional power Doppler analysis in prediction of pre-eclampsia and small for gestational age. Gynecol Obstet Open Acc 01: 108. DOI: 10.29011/2577-2236.100008

**Received Date:** 10 May, 2017; **Accepted Date:** 12 September, 2017; **Published Date:** 22 September, 2017

### Abstract

**Objectives:** To assess the accuracy of placental volume and three-dimensional power Doppler analysis in prediction of pre-eclampsia and little for fertilization age.

**Methods:** 100 ladies undergoing vertebrate scanning were recruited from patient tocology clinic in Zagazig University Hospitals, and Agial Fertility Center. The study was conducted from January 2014 until January 2017 Three-dimensional ultrasound was used so as to live placental volume and 3D-PD indices: organic process index (VI), Flow Index (FI) and organic process flow index (VFI), victimisation the VOCAL computer code. The end result was scored as traditional, PIH, SGA or each.

**Results:** Placental volume alone wasn't a predictor of pre-eclampsia or tiny for fertilization age fetuses. altogether our cases PIH was delicate and developed at thirty-four weeks or additional. The vital finding in our study was the low VI in pregnancies developing pre-eclampsia compared thereto in traditional pregnancies. The FI in our study wasn't totally different in ladies developing pre-eclampsia or SGA.

**Conclusion:** Placental volume wasn't acceptable for early prediction of PIH or SGA, whereas the VI could also be of some potential in detection of PIH.

**Keywords:** Placental volume; Pre-eclampsia; Small for Gestational Age; Three-Dimensional Power Doppler

### Introduction

Early placental volume activity was projected as a predictor of growth-restricted fetuses or pre-eclampsia, either alone or together with arterial blood vessel Doppler [1] or organic chemistry placental markers to predict body anomalies [2]. Hoogland et al. (1980) rumored that pregnancies with little |a little| a tiny low placental space at one hundred fifty days of gestation square measure additional possible to deliver Small for Age (SGA) babies [3]. Placental volume measured at twenty or twenty-five week's victimization two-dimensional ultrasound conjointly foreseen abnormal outcome with high sensitivity and specificity [4]. Placental volume was found to be smaller in pregnancies with high Pulsatil-

ity Index (PI) within the arterial blood vessel [5] moreover as in ladies developing pre-eclampsia [6], however it had been not a decent predictor of SGA fetuses [7]. Placental volume activity [8] and 3D-PD indices of the placenta were found consistent either within the whole volume of the placenta [9] or by placenta tube-shaped structure sonobiopsy [10].

It was rumored that the utilization of Three-Dimensional Power Doppler (3D-PD) ultrasound to assess the placental insertion in traditional and growth-restricted pregnancies between twenty-three and thirty-seven weeks of gestation and over that 3D-PD will give new insights into placental pathophysiology [11]. The purpose of this pilot study was to assess the worth of three-dimensional placental volume activity and 3D-PD indices between ten weeks and half dozen days and thirteen weeks and half dozen days in predicting Pregnancy-Induced High Blood Pressure (PIH)

and SGA newborns.

## Patients and Methods

This prospective study was conducted in Zagazig University Hospitals, and Agial Fertility Center from Gregorian calendar month 2014 until Gregorian calendar month 2017, one hundred consented ladies were listed during this study. Inclusion criteria: pregnant ladies having one vertebrate with identified last discharge amount and early trimester ultrasound confirming the date of the last amount, no active harm or proof of subchorionic intumescency, no proof of thrombophilia or medication treatment (including low dose painkiller or low mass heparin) and no proof of female internal reproductive organ malformation or female internal reproductive organ nonmalignant tumour that would interfere with the amount measurements. Patients with chronic high blood pressure, DM or the other general illness weren't enclosed within the study.

All ladies were examined employing a transabdominal electrical device (3.5-5 MHz, Volusone 730 skilled -GE Medical Systems, Milwaukee, WI, USA). The facility Doppler was applied victimization fastened settings [Pulse Repetition Frequency (PRF): zero.9 MHz, Wall Motion Filter (WMF): low 1]. The three-dimensional program was then activated victimization outside sweep angle to make sure that each one the placental volume was enclosed within the volume non-inheritable. The image was hold on and analyzed once discharge of the patient, victimization VOCAL (virtual organ computer-aided analysis). Volume calculations were performed victimization 30° rotations, and vascularisation index (VI), Flow Index (FI) and vascularisation flow index (VFI) of the placenta were mechanically calculated by the equipment. The VI measures the magnitude relation of variety |the amount |the quantity} of color voxels to the full number of voxels and is believed to specific the presence of blood vessels within the placenta; it's expressed as a share of the placental volume. FI expresses the mean power Doppler signal intensity within the placenta and represents the common intensity of flow. The VFI is that the combination of each the VI and FI (multiplying each indices).

All ladies were contacted once birth and their medical files reviewed. PIH was outlined in keeping with the standards of the International Society for the study of high blood pressure in mater-

nity [12]. SGA newborns were outlined as birth weight of but tenth grade in keeping with native charts [13].

## Ethical Consideration

Institutional Review Board (IRB) approval: The protocol was mentioned by the moral scientific committee for approving the study and consent was obtained before participation.

## Consent Procedure

The Investigator created bound that Associate in nursing acceptable consent method was in situ to make sure that potential analysis subjects, or their approved representatives, were totally aware regarding the character and objectives of the clinical study, the potential risks and edges of study participation, and their rights as analysis subjects. The Investigator obtained the written, signed consent of every subject, or the subject's approved representative, before performing arts any study-specific procedures on the topic. The Investigator preserved the initial signed consent kind.

## Subject Confidentiality

All laboratory specimens, analysis forms, reports, video recordings, and different records that leave the positioning wouldn't embrace distinctive personal information to take care of subject confidentiality.

## Sample Size Calculation

The required sample size has been calculable victimization the facility Analysis and Sample Size software package version 08.0.9 (PASS;NCSS;LLC;Kaysville, Utah). The check used for calculation is that the 2-sided z-test and kind one error has been set at a 2-sided price of zero.05 (confidence level, 95%).

## Results

Twenty-four of one hundred ladies (24%) developed PIH and ten ladies (10%) delivered SGA newborns. The results square measure given in Table 1. There have been no statistically vital variations between the teams with respect to age, age at the examination or delivery, parity or gravidness. The placental volume was similar between the teams. The FI and VFI were similar between the teams, whereas the VI was considerably lower once high blood pressure developed than within the traditional cluster.

	P -value (n=66)	SGA (n=10)	P -value	PIH (n=24)	Normal
Age	27.2 ± 3.2	28.1 ± 2.9	> 0.05	27.4 ± 1.8	> 0.05
BMI	27.3 ± 3.4	27.6 ± 2.5	> 0.05	28.2 ± 1.6	> 0.05
Gestational age at examination (weeks)	11.4± 1.7	12.1 ± 1.6	> 0.05	11.3 ± 1.8	> 0.05
Gestational age at delivery (weeks)	38.5 ±1.3	38.1 ± 1.6	> 0.05	37.8 ± 1.1	> 0.05
Birth weight (g)	3341 ±673	2639 ± 561	< 0.05	2158 ± 336	< 0.05
Parity	3.2 ± 1.2	3.4 ± 1.6	> 0.05	2.9 ± 1.8	> 0.05
gravidity	5.1± 1.8	4.4 ± 2.1	> 0.05	4.1 ± 1.3	> 0.05
VI	13.2 ±2.8	10.2 ± 1.9	< 0.05	12.4 ± 2.6	> 0.05
FI	51.2 ±10.4	52.4 ± 12.6	> 0.05	52.1 ± 10.8	> 0.05
VFI	7.1 ± 1.1	8.1 ± 1.06	> 0.05	7.4 ± 1.3	> 0.05
Placental volume (ml)	59.3± 12.7	58.4 ± 13.6	> 0.05	57.1 ± 14.2	> 0.05

**Table 1:** Shows the clinic-demographic data of patients under the study.

## Discussion

We compared our results for the 3D-PD indices with the results of alternative articles [14,15] and located them terribly similar either as declared within the article itself or by scrutiny of the figures. This likeness emphasizes the very fact that 3D-PD indices are correct and reproducible.

In our study, placental volume alone wasn't a predictor of pre-eclampsia, in distinction to alternative studies [16, 17]. altogether our cases PIH was gentle and developed at thirty-four weeks or additional, whereas in alternative studies, there have been some cases of severe pre-eclampsia developing before thirty-two weeks of gestation; in those patients the placental volume was remarkably smaller. Hence, that subgroup of patients with severe pre-eclampsia, that we have a tendency to didn't encounter in our study, might make a case for the disparate findings [16,17].

In our study, placental volume wasn't found to be an honest predictor of SGA fetuses. This in distinction to people who rumored that placental volume was an honest predictor of SGA as measured within the trimester or together with the PI of the arterial blood vessel. during this report, they performed in Chinese population, the SGA rate was twelve.1%, whereas we have a tendency to encountered solely four.8% SGA newborns. However, we have a tendency to found that SGA fetuses had smaller CRLs compared to acceptable for fetal age (AGA) fetuses. This finding, though logical, has not been rumored antecedently to the simplest of our data and wishes more investigation in larger studies [18].

The necessary finding in our study was the low VI in pregnancies developing pre-eclampsia compared thereto in traditional pregnancies. The VI represents the proportion of the colored voxels, so a lower VI represents fewer vessels within the placenta and

placental bed. It's currently well established that a basic feature of pre-eclampsia is that the pathologic invasion of the spiral arteries by the cytotrophoblast; it's unclear if inadequate invasion results in fewer vessels within the placenta or placental bed. Our finding of lower VI in girls developing PIH raises this risk, which, if true, might make a case for a number of the options of the illness [19].

The FI in our study wasn't totally different in girls developing pre-eclampsia or SGA. This can be in distinction to the findings of that the FI seems to be the foremost reliable index for predicting placental insufficiency (abnormal Doppler studies) in SGA fetuses. They conjointly found that the VI and VFI were considerably lower in placentas of SGA fetuses, however, these indexes had high variability between totally different sampling sites, and since that study was conducted in SGA fetuses between twenty-three and thirty-seven we have a tendency to we cannot compare it to our study, that was performed in pregnancies of earlier stages [20]. A study just like ours was conducted between fourteen and twenty-five weeks of gestation. The findings of exaggerated VI at 16-17 we have a tendency to and 24-25 weeks and exaggerated FI at 18-19 weeks and minimized FI at 24-25 weeks are fascinating however we cannot compare this study to ours as a result of the various weeks of gestation [21].

Our study is proscribed by the tiny variety of cases with PIH. so as to succeed in eightieth power assumptive that VI is five-hitter less in cases with PIH, twenty cases of PIH ought to be enclosed. However, for placental volume to succeed in important power many cases are required. However, these numbers might disagree considerably if severe cases are encountered in future studies.

In conclusion, our results support the belief that low biological process of the placenta in early physiological state indicates that these girls are in danger for developing PIH. The placental

volume in early stages of physiological state was a not reliable predictor of PIH or SGA. Our results ought to be verified in larger studies together with early developing sever cases of PIH with or while not SGA.

## References

1. Bujold E, Effendi M, Girard M, Katy Gouin, Jean-Claude Forest, et al. (2009) Reproducibility of first trimester three-dimensional placental measurement in evaluation of early placental insufficiency. *J Obstet Gynecol Can* 32: 1144-1148.
2. Rizzo G, Capponi A, Cavicchioni O, Vendola M, Arduini D (2008) First trimester uterine Doppler and three-dimensional ultrasound placental volume calculation in predicting pre-eclampsia. *Eur J Obstet Gynecol Reprod Biol* 138: 147-151.
3. Guiot C, Gagliot P, Oberto M, Piccoli E, Rosato R, et al. (2008) Is three-dimensional power Doppler ultrasound useful in the assessment of placental perfusion in normal and growth restricted pregnancies? *Ultrasound Obstet Gynecol* 31: 171-176.
4. Huster MK, Haas K, Schoenborn J, McVean D, Odibo AO (2010) Reproducibility of placental volume and vasculature indices obtained by 3-dimensional power Doppler sonography. *J Ultrasound Med* 29: 911-916.
5. Deurloo K, Spreeuwenberg M, Rekoert-Hollander M, van Vugt J (2007) Reproducibility of 3-dimensional sonographic measurement of fetal and placental volume at gestational ages of 11-18 weeks. *J Clin Ultrasound* 35: 125-132.
6. Rizzo G, Capponi A, Cavicchioni O, Arduini D (2007) Placental vascularization measured by three-dimensional power Doppler ultrasound at 11 to 13 + 6 weeks' gestation in normal and aneuploid fetuses. *Ultrasound Obstet Gynecol* 30: 259-262.
7. Hafner E, Metzenbauer M, Dillinger-Paller B, Hofinger D, Schuchter K, et al. (2001) Correlation of first trimester placental volume and second trimester uterine artery Doppler flow. *Placenta* 22: 729-734.
8. Metzenbauer M, Hafner E, Hofinger D, Schuchter K, Stangl G, et al. (2001) Three-dimensional ultrasound measurement of placental volume in early pregnancy: method and correlation with biochemical placental parameters. *Placenta* 22: 602-605.
9. Burstein E, Sheiner E, Hershkovitz R (2009) Three-dimensional volume measurement between 11 and 13 weeks' gestation. *Am J Perinatol* 26: 169-171.
10. Ilekis JV, Reddy UM, Roberts JM (2007) Preeclampsia-a pressing problem: an executive summary of national institute of child health and human development workshop. *Reprod Sci* 14: 508-523.
11. Law LW, Leung TY, Sahota DS, Chan LW, Fung TY, et al. (2009) Which ultrasound or biochemical markers are independent predictors of small for gestational age? *Ultrasound Obstet Gynecol* 34: 283-287.
12. Schuchter K, Metzenbauer M, Hafner E, Philipp K. (2001) Uterine artery Doppler and placental volume in the first trimester in prediction of pregnancy complications. *Ultrasound Obstet Gynecol* 18: 590-592.
13. Merce LT, Barco MJ, Bau S, Kupesic S, Kurjak A (2005) Assessment of placental vascularization by three-dimensional power Doppler "vascular biopsy" in normal pregnancies. *Croat Med J* 46: 765-771.
14. Hafner E, Metzenbauer M, Hofinger DHO, Stonek F, Schuchter K, et al. (2006) Comparison between three-dimensional placental volume at 12 weeks and uterine artery impedance/notching at 22 weeks in screening for pregnancy-induced hypertension, pre-eclampsia and fetal growth restriction in a low-risk population. *Ultrasound Obstet Gynecol* 27: 652-657.
15. Metzenbauer M, Hafner E, Schuchter K, Philipp K (2002) First trimester placental volume as a marker for chromosomal anomalies: preliminary results from an unselected population. *Ultrasound Obstet Gynecol* 19: 240-242.
16. Davidson S, Sokolover N, Erlich A, Litwin A, Linder N (2008) New and improved Israeli references of birth weight, birth length and head circumference by gestational age: a hospital-based study. *Isr Med Ass J* 10: 130-134.
17. de Paula CFS, Ruano R, Campos JADB, Zugaib M (2009) Quantitative analysis of placental vasculature by three-dimensional power Doppler ultrasonography in normal pregnancies from 12 to 40 weeks. *Placenta* 30: 142-148.
18. Raine-Fenning NJ, Nordin NM, Ramnarine KV, Campbell BK, Clewes JS, et al. (2008) Evaluation of the effect of machine settings on quantitative three-dimensional power Doppler angiography: an in vitro flow phantom experiment. *Ultrasound Obstet Gynecol* 32: 551-559.
19. Tuuli MG, Houser M, Odibo L, Huster K, Macones GA, et al. (2010) Validation of placental vascular sonobiopsy for obtaining representative placental vascular indices by three-dimensional power Doppler ultrasonography. *Placenta* 31: 192-196.
20. Merce LT, Barco MJ, Bau S (2004) Reproducibility of the study of placental vascularization by three-dimensional power Doppler. *J Perinat Med* 32: 228-233.
21. Zalud I, Shaha S (2007) Evaluation of the utero-placental circulation by three-dimensional Doppler ultrasound in the second trimester of normal pregnancy. *J Matern Fet Neonat Med* 20: 299-305.