



The Role of Obstetric Doppler Velocimetry Studies In Predicting Mode of Delivery and Perinatal Outcome

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Abstract

Background: *The antenatal fetal surveillance aims at detecting any evidence of fetal jeopardy at the earliest. The practice of routine late third trimester obstetric ultrasound with Doppler Velocimetry has been shown to improve detection of fetal growth restriction at an early stage when prompt measures can be taken. Ultrasonography with Doppler Velocimetry has become a useful tool in antenatal surveillance because of its safety, non-invasiveness and reliability in antenatal fetal surveillance.*

This study was done to analyze the role of Obstetric Doppler Velocimetry studies in predicting mode of delivery and perinatal outcome.

Methods: *The study was carried out in 112 pregnant females attending the antenatal clinic at Prakash Institute of Medical Sciences, Urun-Islampur and Govt. Medical College, Miraj. All pregnant women above 32 weeks of gestation attending the Obstetrics Outpatient Department were included in the study and they were subjected to ultrasonography with Doppler Velocimetry examination between 32 to 36 weeks of gestation. Antenatal Doppler Velocimetry examination results were used to compare the mode of delivery and perinatal outcome.*

Results:

- Operative interference in form of LSCS was more common in cases with abnormal Doppler Velocimetry findings as compared to those cases with normal Doppler Velocimetry findings (76.48% vs. 16.66%).*
- NICU admission rates were higher among cases with abnormal Doppler Velocimetry as compared to those with normal Doppler Velocimetry (73.53% vs. 7.7%)*

Conclusions: *Abnormal Doppler Velocimetry displayed significant association with operative interference in form of LSCS and also with poor perinatal outcome.*

Keywords: *Ultrasonography, Doppler Velocimetry, NICU Admission, mode of delivery, perinatal outcome.*

INTRODUCTION

The fetal wellbeing is one of the main objectives of antenatal care. The primary objective of antenatal fetal surveillance is to avoid intrauterine fetal death. An ideal secondary objective is to avoid complications in the perinatal period related to intrauterine asphyxia.

The antenatal fetal surveillance aims at detecting any evidence of fetal jeopardy at the earliest so that prompt measures can be taken before the adverse effects of intrauterine asphyxia manifest. The antenatal assessment of fetal wellbeing is an integral part of management of both high risk and low risk pregnancies.

Historically physicians have been monitoring fetal growth by serial measurement of symphysio-fundal height. Antenatal fetal surveillance by clinical examination alone cannot be relied upon in high risk cases.

Advances in medical sciences have made the antenatal fetal surveillance more easy and precise. Various techniques for antenatal fetal assessment have been devised. These techniques aim to identify fetuses that are at risk of preventable morbidity or mortality from uteroplacental insufficiency due to maternal risk factors, placental disorders or fetal disease.

Though there are many antepartum fetal monitoring methods like serial clinical examinations, Non-Stress Test, Vibroacoustic fetal stimulation, Ultrasonography, Biophysical profile, Doppler velocimetry, there is no single test which is ideal for all high risk fetuses. But ultrasonography and Doppler Velocimetry, in experienced hands remain the most informative tests for antenatal fetal assessment.

The antenatal care today aims at identifying growth restricted fetuses by serial measurement of symphysio-fundal height followed by an ultrasound examination of those who are lagging in growth. Routinely this examination is done at 32-36 weeks of gestation.¹ The major advantage of this late third trimester ultrasound examination is catching up with a large population of pregnant women attending antenatal outpatient department

for routine care at a gestational age which is widely used for the assessment of fetal growth and wellbeing.

Revising the physiology, uterine artery undergoes trophoblastic invasion during pregnancy. This physiological process is characterized by loss of the musculoelastic properties of the uterine blood vessels and its conversion to the uteroplacental circulation vessels, which allows an increased blood flow to the placenta and the fetus.²

Pregnancies complicated by impaired placentation such as intra uterine fetal growth restriction, preterm birth, preeclampsia, eclampsia have consistently demonstrated decreased blood flow in the uteroplacental circulation due to increased resistance to blood flow in the uterine artery.³

The effect of abnormal trophoblastic invasion is derived from studies on the uterine artery, umbilical artery and middle cerebral artery. The uterine artery provides a good representation of the sum of resistances of the placental bed and of the placental perfusion.^{4,5} Doppler flow studies of the uterine artery therefore provide an accurate means of assessing uteroplacental resistance to blood flow and a good method of assessing impairment or absence of uteroplacental blood flow.⁵

The practice of routine late third trimester obstetric ultrasound with Doppler velocimetry has been shown to improve detection of fetal growth restriction at an early stage when prompt measures can be taken.⁶ It is of extreme importance to diagnose fetal growth restriction in antenatal period as it prompts further investigations like umbilical artery Doppler which has been shown to reduce the frequency of stillbirths by timely intervention by preterm delivery.⁷

The complications of impaired placentation are significant contributors to maternal and perinatal morbidity and mortality in developing countries.^{8,9,10} Therefore it is justified to recommend Doppler velocimetry of the uterine artery in developing countries because of the high prevalence of mortality and morbidity due to complications of impaired placentation. Umbilical

artery Doppler also carries a prognostic value in predicting the outcomes of growth restricted fetuses. Therefore its use is recommended to reduce perinatal mortality and morbidity.¹¹

This study was done to analyze the role of Obstetric Doppler Velocimetry studies in predicting mode of delivery and perinatal outcome.

METHODS

The study was carried out in 112 pregnant patients attending the antenatal clinic at Prakash Institute of Medical Sciences, Urun-Islampur, Dist.Sangli and Govt. Medical College, Miraj, Dist. Sangli. All pregnant women above 32 weeks of gestation attending the Obstetrics Outpatient Department were included in the study.

These pregnant women were subjected to Obstetric Ultrasound with Doppler Velocimetry at 32-36 weeks of gestation. These women were followed up till time of delivery.

The outcomes observed were:

1. Mode of delivery: LSCS vs. Normal delivery
2. NICU admission rates.

Outcomes were compared with respect to antenatal Obstetric Ultrasound with Doppler Velocimetry results.

Informed written consent of the patient was obtained before enrolment into the study.

It was a prospective comparative study conducted at Department of Obstetrics and Gynecology and Department of Radiology at Govt. Medical College, Miraj and Prakash Institute of Medical Sciences, Urun-Islampur.

All pregnant women above 32 weeks of gestation with cephalic presentation attending the Obstetrics Outpatient Department of Govt. Medical College, Miraj and Prakash Institute of Medical Sciences, Urun-Islampur were included in the study.

Exclusion criteria for this study were: Intrauterine fetal death, Antepartum hemorrhage, Placenta Previa, Previous LSCS, All non-cephalic presentations and Cephalopelvic disproportion.

At our centers, all ultrasound examinations were performed by certified Radiologists with special experience in Obstetric Ultrasound examination. The ultrasound machines used were equipped with a 2-6 MHz linear curved array transducer. Estimated fetal weight (EFW) was calculated using Hadlock's formula¹² which uses biparietal diameter, head circumference, abdominal circumference and femur length. In cases with EFW <10th centile of the standards, Umbilical artery Doppler examination was carried out to measure pulsatility index (UA-PI)¹³. Pulsed Doppler measurements were performed automatically, based on at least three consecutive waveforms. Trans-abdominal ultrasound examination was done to visualize umbilical artery and middle cerebral artery which were subjected to Doppler velocimetry examination. Pulsed wave Doppler was then used to evaluate impedance to flow, when three similar waveforms were obtained consecutively the Pulsatility index was measured^{14, 15}.

Statistical Methods and Data Analysis

In this project all statistical analysis were performed by using 20.0 version of statistical software SPSS.

Descriptive Analysis

Continuous variables were summarized by using summary statistics (number of observations, mean, standard deviation or median with range of minimum and maximum). Categorical values were summarised by using frequencies and percentages.

Tests of Significance

In this study, all efficacy variables like association between Ultrasonography results with all other parameters like mode of delivery and NICU admission status were analyzed by estimating chi Square test.

RESULTS

A total of 112 cases were included in the study. All cases had at least one antenatal Obstetric Ultrasound with Doppler Velocimetry available to

compare with the outcome. Out of 112 cases, 78 cases had a normal Doppler Velocimetry while 34 cases had at least one abnormal finding at Doppler Velocimetry. A comparison was done between these two groups with respect to following outcomes:

Table 1. Association between Doppler Velocimetry Result and Mode of Delivery

Doppler Velocimetry Result	Vaginal Delivery		L.S.C.S	
	No	%	No.	%
Normal (N = 78)	65	83.33	13	16.66
Abnormal (N = 34)	8	23.52	26	76.48
Total	73		39	

By Chi-Square test
P< 0.0001*Significant

A total of 13 cases with normal Doppler Velocimetry required operative intervention in the form of LSCS while the number was 26 among those with an abnormal Doppler Velocimetry finding.

This reveals that, 76.48% of the cases with abnormal Doppler Velocimetry finding had undergone LSCS which was significantly more as compared to 16.66% of those cases with a normal Doppler Velocimetry finding.

Table 2. Association between Doppler Velocimetry Result and NICU Admission

Doppler Velocimetry Result	No NICU		NICU	
	No.	%	No.	%
Normal (N = 78)	72	92.30	6	7.7
Abnormal (N = 34)	9	26.47	25	73.53
Total	81		31	

By Chi-Square test
P< 0.0001*Significant

A total of 6 newborns born to mothers with a normal Doppler Velocimetry required NICU admission while the number was 25 among those with an abnormal Doppler Velocimetry finding.

This reveals that 73.53% of the newborns born to pregnant women with an abnormal Doppler Velocimetry finding required NICU admission

which was significantly more as compared to 7.7% of the newborns born to mothers with a normal Doppler Velocimetry.

CONCLUSIONS

Obstetric Ultrasonography has been a widely used tool of antenatal fetal surveillance. Ultrasonography with Doppler Velocimetry is the most informative test for antenatal fetal surveillance.

The major objective of this study was to analyze the role of Obstetric Doppler Velocimetry studies in predicting mode of delivery and perinatal outcome.

In this study, we measured maternal outcome in terms of mode of delivery while perinatal outcome in terms of NICU admission.

Major conclusions of the study were:

1. Abnormal Doppler Velocimetry was significantly associated with operative intervention in the form of LSCS. Thus it affected the mode of delivery in a significant number of cases.
2. Abnormal Doppler Velocimetry was significantly associated with more rates of NICU admissions. Thus it signifies association between abnormal Doppler Velocimetry and poor perinatal outcome.

To conclude, Doppler Velocimetry can reliably predict the mode of delivery and perinatal outcome. Thus Doppler Velocimetry can be used as a precise, safe, non-invasive and reliable means of antenatal fetal surveillance which would help in improving maternal as well as perinatal outcome. Though more studies on larger scale are required to improve the current recommendations.

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