

PERINATAL OUTCOME OF IUGR FETUSES HAVING NORMAL AND ABNORMAL UMBILICAL ARTERY DOPPLER STUDY

Zonia Zaman*, Fatima Imran*, Aurangzeb Bantth***

*Assistant professor, Department of Obstetrics and Gynecology, Aziz Fatimah Hospital, Faisalabad.

**Assistant professor, Department of radiology, Aziz Fatimah Hospital, Faisalabad.

***Assistant professor, Department of radiology, independent university Hospital and medical college, Faisalabad.

ABSTRACT:

OBJECTIVE: To compare the perinatal outcome of IUGR fetuses having normal and abnormal umbilical artery Doppler study.

Study Design: Descriptive Case series study

Place and Duration of Study: This study was conducted from March 2015 to February 2016 in departments of radiology and obstetrics & gynecology Aziz Fatimah hospital Faisalabad.

Methodology: In this study a total of 172 pregnant women with diagnosed IUGR between 28-40 weeks were included. These patients were divided in to two groups, first group was consisted on 94 pregnant women with IUGR and having normal Doppler ultrasound and second group consisted of 78 women with diagnosed IUGR and having abnormal Doppler ultrasound findings. The IUGR was diagnosed by ultrasonography having estimated weight <10th percentile for gestational age. All the patients in study were followed till delivery and maternal and fetal outcomes were noted in both groups.

RESULT:

The mean age of group I was 26±5.25 years, and group II was 25±4.18 years. Normal vaginal deliveries were significantly higher (56.38% vs 24.36%, p-value < 0.001) in normal UA Doppler group and C-section rate was significantly (75.64% vs 43.62%) greater in abnormal UA Doppler group. The rate of good APGAR score (> 7) was significantly higher at one minute (75% vs 44.87%, p-value < 0.001) and 5 minute (91.5% vs 71.79%, p-value < 0.001) in women having normal UA Doppler study findings. There were significantly more (58.97 vs 17.02%, p-value < 0.001) preterm deliveries with abnormal doppler study. Birth weight of the babies in abnormal UA Doppler findings was significantly (p-value < 0.001) less with mean weight of 945±168 grams as compared to mean birth weight of 1585±223 grams of babies of normal UA Doppler study. NICU admissions (71.79% vs 20.21%, p-value < 0.001) were significantly greater in women having abnormal UA Doppler findings.

Conclusion: There is a strong relationship between perinatal outcome and umbilical artery Doppler velocimetry. With abnormal UA Doppler there are significantly greater chances of adverse perinatal outcome.

Key Words: Intrauterine Growth Retardation, Doppler Echocardiography, perinatal outcome, Umbilical Artery

INTRODUCTION:

A standard utero placental circulation is necessary for the development of a normal pregnancy. Fetal birth weight less than 10th percentile for a given gestational age is called intrauterine growth retardation (IUGR). The most important thing is to identify the fetuses

Corresponding Author:

Dr. Zonia Zaman, Assistant professor,
Department of Obstetrics and Gynecology, Aziz
Fatimah Hospital, Faisalabad.

Email: drzoniaz4866@hotmail.com

with hazard of compromise instead of identification of small fetus during pregnancy.¹ Intrauterine growth retardation affects about 10-15% of the maternal population and is a common condition affecting pregnant mothers. This condition has many risks for the babies including increased chances of fetal death, neonatal lung diseases, respiratory distress syndrome, necrotizing enterocolitis, renal diseases and chronic cardiovascular disorders. IUGR fetus has a strong connection with meconium aspiration syndrome.² An IUGR fetus has increased chances of perinatal morbidity and mortality due to environmental damage or genetic disease or utero placental insufficiency and reduced placental perfusion.³ IUGR is a disorder in which fetus fails to get its normal potential of growth so the babies show a pattern of small for gestational age. Any deviation from normal growth indicates any associated impairment in the fetus. This impairment can be due to hypertension during pregnancy which can lead to defects in circulation producing prematurity or fetal mortality. A well-known and noninvasive method for the measurement of variations in blood flow is Doppler ultrasound velocimetry. Doppler is also used for uteroplacental and fetoplacental circulation for the assessment of fetal wellbeing.⁴

Normal umbilical artery Doppler studies have shown a better fetal outcome in comparison to those having abnormal UA Doppler indices. Umbilical artery Doppler is performed in all IUGR fetuses, so that to identify fetus at risk. On the basis of previous randomized trials it can be concluded that management based on UA Doppler significantly improve maternal outcomes like antenatal admission, elective delivery and induction of labour.^{5,6}

A non-invasive technique with no any ionizing radiations together with easy availability is Umbilical artery Doppler.⁷ This can be used in cases with IUGR for prediction of perinatal outcome by helping in suitable management in time.⁸

In a clinical study comparing fetal outcome of IUGR in women having normal and abnormal uterine artery Doppler study, a significant difference in perinatal outcome was recorded. In women having normal UA Doppler findings (16%) deliveries were premature and 46% in

the abnormal UA Doppler were premature. The fraction of babies having low birth weight was less in normal UA Doppler group. The rate of NICU admission was significantly more in women having abnormal UA Doppler findings. Intra ventricular haemorrhage (IVH) was more common in women having abnormal umbilical artery Doppler findings (11% vs. 4%) in contrast with normal UA Doppler group. Similarly fetal mortality rate was significantly higher in the abnormal umbilical artery Doppler group as compared to normal group.⁹

The main objective of this present study was to evaluate the efficacy of Doppler study of umbilical artery flow in fetuses diagnosed with IUGR in terms of normal and abnormal Doppler findings. Which have higher risk of perinatal complications, so that proper management may be represented for a good prognosis of these fetuses.

METHODOLOGY:

This study was started after taking approval from hospital ethical committee. This study was conducted in radiology and obstetrics & gynecology department Aziz Fatimah hospital Faisalabad in one year time from March 2015 to February 2016. In this case series, study a total of 172 pregnant women with diagnosed IUGR was included. These patients were divided in two groups, first group was consisted on 94 pregnant women with IUGR and having normal Doppler ultrasound and second group consisted of 78 women with diagnosed IUGR and having abnormal Doppler ultrasound findings. Patients were selected by non-probability consecutive sampling technique.

Pregnant women of 20 to 40 years old, with any parity and having diagnosed IUGR and gestational age > 28 weeks were briefed about the study and informed written consent was taken before including in the study. The exclusion criteria was women with multiple gestational pregnancies and congenital abnormalities. Estimated fetal weight < 10th percentile for gestational age was taken as IUGR, diagnosed by ultrasonography.

The starting criteria of pregnancy was taken through last menstrual cycle and ultrasound scan from first trimester. IUGR was diagnosed clinically and its confirmation was made through ultrasonography. The fetal biometry

including biparietal diameter, head circumference, abdominal circumference and femur length were noted for every patient. Had Lock formula was used to estimate fetal weight. All patients included in the study had UAD study and were divided into two groups. In group 1 94 women having IUGR and normal UAD flow were included. Group 2 consisted of 78 women having IUGR and abnormal UAD study. The pattern of spectral waveform was noted. The information regarding diastolic flow as normal, low, absent or reversed was noted (figure 1). Along with analyzing the spectral waveforms and other growth parameters some additional measurements of Doppler like PI, RI, S/D ratio were also observed.

All the patients in study were followed till delivery and maternal and fetal outcomes were noted in both groups. The maternal outcome was measured in terms of preterm delivery (birth of a baby at less than 37 weeks of gestation), mode of delivery and induction of labour. The perinatal outcome was assessed in terms of birth weight, APGAR score, NICU admission, respiratory distress syndrome, perinatal and neonatal death. All the collected data was entered and analyzed through SPSS v 16. Mean along with standard deviation was calculated for numerical variables. Frequency and percentages were presented for qualitative variables. Independent sample t-test was used to compare means of numerical data and chi-square test for categorical data. The level of significance was set at p -value < 0.05 .



Fig 1: Raised S/D ratio in umbilical artery in IUGR fetus

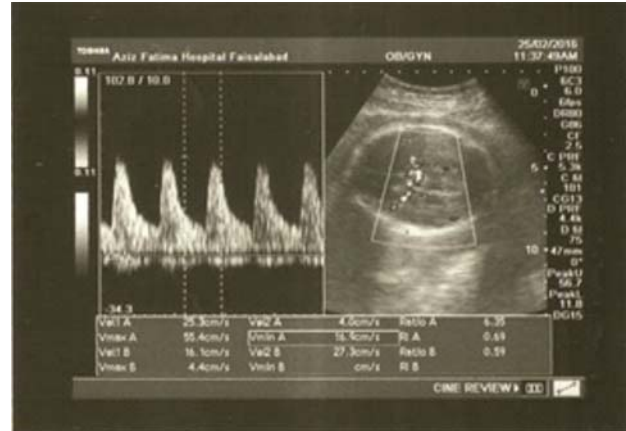


Fig 2: High diastolic velocities in middle cerebral artery in IUGR fetus

RESULTS:

In this study a total of 172 pregnant women with IUGR were included in which women with normal UA Doppler were included in group I and women with IUGR and having abnormal UA Doppler finding were included in group II. The mean age of group I was 26 ± 5.25 years, which was not significantly different from group II, in which mean age was 25 ± 4.18 years.

According to the results of the study it was noted that there was significant difference in mode of delivery between both groups. Normal vaginal deliveries were significantly higher (56.38% vs 24.36%, p -value < 0.001) in normal UA Doppler group in contrast to abnormal UA Doppler group. Similarly the C-section rate was significantly (75.64% vs 43.62%) greater in abnormal UA Doppler group as compare to normal UA Doppler group as shown in table 1.

The APGAR score at one minute was noted significantly better in normal Doppler findings group in contrast to abnormal Doppler study group. It was noted that the rate of good APGAR score (> 7) was significantly higher at one minute (75% vs 44.87%, p -value < 0.001)

and 5 minute (91.5% vs 71.79%, p -value < 0.001) in women having normal UA Doppler study findings as compared to those having abnormal UA Doppler findings as elaborated in table 2.

There were significantly more (58.97% vs 17.02%, p -value < 0.001) preterm deliveries among women having abnormal UA Doppler study as compared to normal UA Doppler findings. The birth weight of the babies in abnormal UA Doppler findings was significantly (p -value < 0.001) less with mean

weight of 945 ± 168 grams as compared to mean birth weight of 1585 ± 223 grams of babies delivered by women having normal Doppler findings. The babies from the mothers having abnormal Doppler findings had significantly more NICU admissions (71.79% vs 20.21%, p-value < 0.001) as compared to women having normal UA Doppler findings.

Intraventricular hemorrhage (14.10% vs 4.26%, p-value < 0.05) was significantly greater in abnormal Doppler study group as compared to normal Doppler findings. Perinatal deaths are twice in abnormal UAD as compared to normal Doppler study as shown in table 3.

Table 1: Comparison of mode of delivery between normal and abnormal Doppler study finding groups

Mode of delivery	Normal UA Doppler (n=94)		Abnormal UA Doppler (n=78)		P-Value
	Frequency	Percentage	Frequency	Percentage	
Spontaneous Vaginal Delivery	53	56.38%	19	24.36%	0.000 **
C-section	41	43.62%	59	75.64%	
Total	94	100.00%	78	100.00%	

** Significant at 0.01 level of significance

Table 2: Comparison of mode of delivery between normal and abnormal Doppler study finding groups

APGAR score	Normal UA Doppler (n=94)		Abnormal UA Doppler (n=78)		P-Value
	< 7	> 7	< 7	> 7	
At One Minute	24 (25%)	70 (75%)	43 (55.12%)	35 (44.87%)	0.000 **
At five Minute	8 (8.5%)	86 (91.5%)	22 (28.2%)	56 (71.79%)	0.000 **

** Significant at 0.01 level of significance

Table 3: Comparison of fetal outcome between normal and abnormal Doppler study finding groups

Parameter	Normal UA Doppler (n=94)		Abnormal UA Doppler (n=78)		P-Value
	Frequency	Percentage	Frequency	Percentage	
Premature delivery	16	17.02%	46	58.97%	0.000 **
Birth Weight	1585±223 Gram		945±168 Gram		0.000 **
NICU Admission	19	20.21%	56	71.79%	0.000 **
IVH †	4	4.26%	11	14.10%	0.0226 *
Perinatal death	5	5.32%	10	12.82%	0.0826 €

*Significant at 0.05 level of significance

**Significant at 0.01 level of significance

€ Insignificant at 0.05 level of significance

† Intraventricular hemorrhage

DISCUSSION:

Possible perinatal outcome can be predicted on the basis of umbilical artery Doppler study which is a non-invasive and easily available technique in patients diagnosed with IUGR. The Doppler study findings are very useful for obstetrical decisions, especially in pregnancies diagnosed with IUGR. Still some disagreement is available to decide the best fetal vessel which should be used for Doppler study for continuation or discontinuation of pregnancy. There are several recommendations from authorities for the use of umbilical artery Doppler but it also requires supplemented information for other vessels like middle cerebral artery and ductus venosus for a better decision making. The Doppler study should be performed preferably by or under supervision of a skilled ultrasonographer. Deviation of Doppler waveforms of the venous system is a strong forecaster for fetal anomalies especially prior to 32 weeks of gestation.¹⁰ Moreover, changes in MCA may reflect advanced stages of fetal hypoxia, where many fetuses are not salvageable. For all these reasons, umbilical artery Doppler is preferred in clinical settings.

The presence of a very low artery vascular resistance indicates a compromised umbilical artery diastolic flow (figure.2). Cerebral hemorrhage may be caused by abrupt cerebral hyperperfusion. Umbilical artery Doppler can help in the detection of fetal hypoxia along with changes in fetal circulation.¹¹

Umbilical and uterine artery Doppler study helps in the comprehension of hemodynamic variations in utero-placental and fetoplacental circulations which can be affected by hypertension in pregnancy. Uterine artery waveforms are considered abnormal when S/D ratio > 2.7 and with persistence of diastolic notch after 26 weeks of gestation are predictors of development of IUGR later.¹²

Any variation in uterine and umbilical artery circulation has a strong relationship with pregnancy outcome. In these pregnancies, Doppler is a principal technique for fetomaternal observation. The pattern of umbilical artery is a strong predictor of fetal outcome in contrast to uterine artery circulation.¹³

In this present study, the mean age of group I was 26 ± 5.25 years, which was not significantly different from group II, in which the mean age was 25 ± 4.18 years. Which are in agreement with other studies.^{2,3}

According to the results of the study, it was noted that there was a significant difference in the mode of delivery between both groups. Normal vaginal deliveries were significantly higher (56.38% vs 24.36%) in the normal UA Doppler group in contrast to the abnormal UA Doppler group. Similarly, the C-section rate was significantly (59% vs 41%) greater in the abnormal UA Doppler group as compared to the normal UA Doppler group. Which is similar to a previous study by Gandhi K, et al,¹¹ who found that 69.6% of IUGR fetuses having abnormal Doppler flow were delivered by caesarean section, remaining 30.4% delivered vaginally. And another study by Lakhakar et al,¹⁴ showing 62% of caesarean rate in abnormal Doppler flow and 38% vaginal birth in their study.

Umbilical artery Doppler examination is an important parameter for clinical decision making. The adverse perinatal outcome can be predicted on the basis of S/D ratio, which is thought to have a sensitivity index of 66.6 for prediction of fetal outcome. So it can be recommended that fetuses diagnosed with IUGR should be followed through UA Doppler for better prognosis and management of growth-retarded fetuses. Any abnormal Doppler waveforms in the presence of IUGR along with absent end

diastolic flow are strong indicators of adverse fetal and perinatal outcomes before 32 weeks of gestation.^{15,16}

In the present study, it was noted that the APGAR score at one minute was significantly better in the normal Doppler findings group in contrast to the abnormal Doppler study group. It was noted that the rate of good APGAR score (> 7) was significantly higher at one minute (75% vs 44.87%) and 5 minutes (91.5% vs 71.79%) in women having normal UA Doppler study findings as compared to those having abnormal UA Doppler findings. These are supported by other studies as well.¹⁷

In this present study, it was noted that there were significantly more (58.97% vs 17.02%) preterm deliveries among women having

abnormal UA Doppler study as compared to normal UA Doppler findings. Similarly the results of this present study showed that birth weight of the babies in abnormal UA Doppler findings was significantly less with mean weight of 945 ± 168 grams as compared to mean birth weight of 1585 ± 223 grams of babies delivered by women having normal Doppler findings. The babies from the mothers having abnormal Doppler findings had significantly more NICU admissions (71.97% vs 20.21%) as compared to women having normal UA Doppler findings. All these results are supported by many other studies like study by Ghosh GS,¹⁸ in which it was observed that abnormal UA Doppler group had poorer perinatal outcomes including preterm delivery (<37 weeks of gestation), caesarean section, and admission of the neonatal baby to NICU. Similarly Rana MJ found that 82% cases with abnormal UA Doppler delivered prematurely by caesarean section.¹⁹

After diagnosis of IUGR it is necessary to monitor the fetus with care for better prognosis. For obstetricians umbilical artery Doppler is a useful tool for better management of these cases to get maximum possible development in uterus.

With diagnosis of IUGR fetus the mother may be given a closed attention clinically and a proper follow up with series of umbilical artery Doppler for monitoring of fetus growth condition and a good prognosis of the pregnancy.¹⁹

CONCLUSION:

The findings of this study demonstrate that there is a robust affiliation of perinatal outcome with umbilical artery Doppler velocimetry. With abnormal UA Doppler there are significantly greater chances of adverse perinatal outcome. So UA Doppler is a convenient tool without any risk for mother and fetus, because it involves no ionization or radiation. This is a technique which should be used in all cases of IUGR for prediction of fetal outcome and identification of neonates at risk.

REFERENCES:

1. Gardosi J. Clinical strategies for improving the detection of fetal growth restriction. *Clin Perinatol* 2011; 38:21–31.
2. Malhotra N, Chanana C, Kumar S, Roy K, Sharma JB. Comparison of perinatal outcome of growth-restricted fetuses with normal and abnormal umbilical artery doppler waveforms. *Indian J Med Sci.* 2006; 60(8): 311-7.
3. Al Qahtani N. Doppler ultrasound in the assessment of suspected intra-uterine growth restriction. *Ann Afr Med* 2011; 10(4): 266–71.
4. Smitha K, Sowmya K, Malathi T. Study of Doppler waveforms in pregnancy induced hypertension and its correlation with perinatal outcome. *Int J Reprod Contracept Obstet Gynecol* 2014; 3: 428-33.
5. Smith, James F. Fetal health assessment using prenatal diagnostic techniques *Current Opinion in Obstet Gynaecol* 2008; 20: 152-6.
6. Arora D, Desai SK, Sheth PN, Kania P. Significance of umbilical artery velocimetry in perinatal outcome of growth restricted fetuses. *J Obstet Gynaecol India* 2005; 55: 138-43.
7. Soregaroli M, Bonera R, Danti L, Dinolfo D, Taddei F, Valcamonica A, et al. Prognostic role of umbilical artery Doppler velocimetry in growth-restricted fetuses. *J Matern Fetal Neonatal Med* 2002; 11: 199–203.
8. Siddiqui TS, Asim A, Ali S, Siddiqui TS, Tariq A. Comparison of perinatal outcome in growth restricted fetuses retaining normal umbilical artery Doppler flow to those with diminished end-diastolic flow. *J Ayub Med Coll Abbottabad.* 2014; 26(2): 221-4.
9. Ali A, Ara I, Sultana R, Akram F, Zaib MJ. Comparison of perinatal outcome of growth restricted foetuses with normal and abnormal umbilical artery Doppler waveforms. *J Ayub Med Coll Abbottabad* 2014; 26(3): 344-8.
10. Yagel S, Kivilevitch Z, Cohen SM, Valsky DV, Messing B, Shen O, et al. The fetal venous system, part II: ultrasound evaluation of the fetus with congenital

- venous system malformation or developing circulatory compromise. *Ultrasound ObstetGynecol* 2010;36:93–111.
- 11 .Gandhi K, Mehta AV. Role of Doppler Velocimetry in growth restricted fetuses. *NHL J Med Sci.* 2015;4(1):27-30.
 12. MeghnaToal, ShafaghFallah, Cynthia, Chan:Usefulness of placental profile in high risk pregnancies. *Am. J. ObstetGynecol* 2007;196(4):363.
 13. Berkley E, Chouhan S, Abuhamad A. Doppler assessment of fetus with intrauterine growth restriction. *AJOG;* 2012;300-8.
 14. B.M. Lakhakar, H.V. Rajgopal P.T. Gourishankar: Doppler prediction of adverse perinatal outcome in PIH and IUGR. *Indian J Radiol*2006;16:109-16.
 15. Malhotra N, Chanana C, Kumar S, Roy K, Sharma JB. Comparison of perinatal outcome of growth – restricted fetuses with normal and abnormal umbilical artery Doppler waveforms. *Indian J Med Sci.* 2006; 60: 311-7.
 16. Schwarze A, Gembruch U, Krapp M, Katalinic A, Germer U, Axt – Fliedner R. Qualitative venous doppler flow waveform analysis in preterm intrauterine growth restricted fetuses with absent end diastolic flow in the umbilical artery correlation with short term outcome. *Ultrasound Obstet Gynecol.* 2005; 25: 573-9.
 - 17 .Rana MJ, Amanullah A, Farooq O. The Role of Umbilical Artery Doppler in detection and Management of Fetal Growth Retardation. *Biomedica.* 2005;21:4-7.
 18. Ghosh GS, Gudmundsson S. Uterine and umbilical artery Doppler are comparable in predicting perinatal outcome of growth-restricted fetuses. *British JObsGynaecol.* 2009;116:424–30.
 19. Rana MJ, Amanullah A, Farooq O. The role of umbilical artery Doppler in detection and management of fetal growth retardation. *Biomedica* 2005;21:4–7.

Submitted for publication: 12-07-2016

Accepted for publication: 15-09-2016

SR #	AUTHOR NAME	CONTRIBUTION
1	Zonia Zaman	Collection Data, analysis
2	Fatima Imran	Proof Reading
3	Aurangzeb Bantth	Data Review

IF THE RIGHT USURPED FROM US IS GIVEN BACK TO US WE SHALL TAKE IT,
OTHERWISE WE SHALL GO ON CLAIMING IT.

Hazrat Ali (Karmulha Wajhay)