



## Role of Doppler in Fetal Growth Restriction and its Relation with Neonatal Outcome

Harpreet Kaur<sup>1</sup>, Balpreet Kaur<sup>2\*</sup> and Anamika Garg<sup>3</sup>

<sup>1</sup>Associate Professor, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, India

<sup>2</sup>Assistant Professor, All India Institute of Medical Sciences, Bathinda, Punjab, India

<sup>3</sup>Junior Resident, Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab, India

**\*Corresponding Author:** Balpreet Kaur, Assistant Professor, All India Institute of Medical Sciences, Bathinda, Punjab, India.

**Received:** June 23, 2021

**Published:** July 09, 2021

© All rights are reserved by **Balpreet Kaur, et al.**

### Abstract

**Introduction:** Fetal growth restriction effects 10% of total pregnancies. 20% of still born infants have fetal growth restriction. Doppler ultrasound has an important contribution to monitor the surveillance of growth restricted fetuses.

**Method:** It is a retrospective longitudinal study conducted on antenatal women diagnosed with fetal growth restriction after 26 weeks of gestation who are admitted in G.G.S medical college from January 2017 to December 2018 with fetal growth restriction. Doppler indices were evaluated and correlated with fetal outcome.

**Results:** 87.5% of women with growth restricted fetuses had abnormal Doppler findings. Abnormal Doppler finding in patients who underwent caesarian section were significantly more.

**Conclusion:** To protect fetuses from sudden demise in a hostile intrauterine environment Doppler ultrasound provides an important contribution. Doppler changes reveal fetal hypoxia atleast a week before the non-stress test or the biophysical profile. It has therefore become the gold standard in the management of fetal growth restriction.

**Keywords:** Doppler; Women; Middle Cerebral Artery

### Introduction

The growth of human fetus is a complex process resulting in an increase in size overtime. For normal fetal growth adequate maternal and fetal blood flow in the uterus and fetoplacental circulation is required.

Fetal growth restriction refers to a condition in which the fetus is unable to achieve its genetically determined potential size [1] and an estimated fetal weight is less than the 10<sup>th</sup> percentile corresponding to the gestational age [2].

When the hyperplasia and hypertrophy in the second and third trimester take place in a suboptimal manner it results in deficit growth in the fetal weight, size and maturation of fetal metabolism which is called as fetal growth restriction [3].

Fetal growth restriction can be symmetrical or asymmetrical depending upon the etiology and time of onset.

Fetal growth restriction effects 10% of the total pregnancies [1] and 20% of stillborn infants have fetal growth restriction. Perinatal mortality rates are 4-8 times higher for growth restriction infants. Morbidity is present in 50% of the surviving infants. In India ac-

According to recent UNICEF surveys incidence of fetal restriction is 25-30% [4].

Diverse factors, including fetal condition as well as maternal and environmental factors can lead to fetal growth restriction. Among maternal causes chronic malnutrition/starvation and severe anaemia have a great share [3,5].

Chronic placental separation and placental insufficiency are among the most frequent causes of fetal growth restriction [6]. Chromosomal and structural anomalies, fetal infection, teratogens are also associated with growth restriction [3,4].

The failure of a fetus to attain its expected growth may result from different complications, the final common most often encountered is via uteroplacental insufficiency. Placental insufficiency promotes compensatory changes in fetal circulation i.e. development of abnormal vascular resistance pattern. This leads to compromise of fetal well being with 6-10 times higher risk of perinatal mortality [7].

Accurate and timely detection of IUGR can prevent adverse outcome of pregnancy to some extent.

Doppler ultrasound has an important contribution to monitor the surveillance of growth restricted fetuses.

The Doppler pattern follow a longitudinal trend with early changes in umbilical artery and middle cerebral artery followed by other peripheral arteries [6].

Umbilical vessels for the placental, middle cerebral artery for preferential brain perfusion and precordial veins for the cardiac effects of placental dysfunction are taken into consideration [7].

Doppler changes reveal fetal hypoxia atleast a week before the non-stress test or bio-physical profile. It has therefore become the gold standard in the management of fetal growth restriction [8].

### Aims and Objectives

- To determine the ultrasonographic Doppler parameters in the growth restriction fetuses in umbilical artery, middle cerebral artery and ductus venosus.
- To correlate the Doppler parameters with fetal outcome in view of and gestational age at delivery, timing and mode of

delivery with birth weight, apgar scores, still births and neonatal deaths.

### Materials and Methods

This is a retrospective longitudinal study conducted on antenatal women diagnosed with fetal growth restriction after 26wks of gestation who are admitted in labour unit of dept of Obs and Gynae at Guru Gobind Singh medical college from January 2019 to 31<sup>st</sup> December 2019.

#### Inclusion criteria

- Women with singleton pregnancy of  $\geq 26$  weeks of gestation with a discrepancy of more than 4 weeks on clinical evaluation irrespective of maternal disease.
- Antenatal cases  $\geq 26$  weeks of gestation with EFW less than 10<sup>th</sup> percentile of the corresponding gestational age on ultrasonography irrespective of maternal disease.

#### Exclusion criteria

- Fetuses with diagnosed chromosomal or structural abnormalities.
- Multiple gestations.
- Intrauterine fetal demise.

Informed written consent was taken, detailed medical history and thorough medical examination was done.

Parameters observed were-systolic/diastolic (S/D) ratio, pulsatility index (PI), resistance index (RI) absent or reversed end diastolic flow in umbilical artery.

Conservative management was done depending on the Doppler finding and maternal disease. Pregnancy was terminated according to maternal condition and other obstetrical indications.

Doppler indices were evaluated and correlated with fetal outcome. Fetal outcome in women with diminished/absent/reversed flow in the umbilical artery was compared with fetal outcome in patients with normal doppler findings.

### Observation and Results

The present study was conducted from 1/1/19 to 31/12/19 on 48 antenatal women with more than or equal to 26 weeks with fetal growth restriction admitted to labour room unit of G.G.S medi-

cal college, Faridkot. Out of 48 women 54.16% were primigravida and 45.83% were multigravida. The difference was not statistically significant. Maximum number of patients were between 34 weeks to 40 weeks of gestation depicting a late onset fetal growth restriction as compared to 37.5% women with an early FGR. Pre-eclampsia was the most common indication of admission present in 54.16%. Only 12.5% of women had normal Doppler finding as compared to 87.5% women with abnormal Doppler findings. The difference in the groups had statistical significance. In umbilical artery Doppler examination S/D ratio was normal in 47.91% and elevated in 52.08%. The difference was not significant. PI was found normal in 27.08% and elevated in 72.91% which was statistically significant. Significant difference was observed in RI value which was normal in 31.25% of women and elevated in 68.75% of women. Middle cerebral artery Doppler study shows significant difference in S/D ratio which was normal in 66.66% women and decreased in 33.33% women. Significance was observed as P value was normal in 68.75% cases and decreased in 37.25% women. RI value was normal in 52.08% of women and decreased in 47.91% of women which was not significant. Reversed flow in ductus venosus was seen in Doppler flow study in 1 patient which was statistically significant. All the 48 patients had normal forward wave flow. Out of 48 neonates 47.91% were LBW, 27.08% were VLBW and 25% were ELBW. Adverse outcome included stillbirths, neonatal deaths, 5 minutes Apgar score less than 7, intubation, NICU stay > 7 days. Non-adverse outcome includes neonates with NICU stay < 7 days or those who are shifted to mother side and had no NICU stay. 52.08% had adverse perinatal outcome. There were 4 - 16% still births, 10.4% had neonatal death with total perinatal mortality 14.57%. Abnormal Doppler findings in patients who underwent caesarean section were significantly more (87.5%) than the patients who had vaginal delivery (75%). 91.66% extremely low birth baby, 76.92% of very low birth weight baby had abnormal Doppler finding which is significant. 50% neonates with low Apgar score had abnormal Doppler findings. In 6 intubated neonates 83.33% had abnormal Doppler finding. 100% of stillbirths had abnormal Doppler finding and 80% of neonatal death had abnormal Doppler findings.

## Discussion

The study was done on 48 women at or more than 26 weeks of gestation with fetal growth restriction who were admitted in labour room of G.G.S medical college, Faridkot from January 2017 to December 2017.

Danish, *et al.* [14] concluded that antenatal checkup improves the detection rate of FGR, hence there were more numbers of booked patients.

37.5% of women were less than 34 weeks of gestation depicting early onset FGR where as 62.49% of the patients were monitored between 34 - 40 weeks of gestation when fetus has developed sufficient lung maturity to survive outside the uterus depicting a late onset FGR noted by Deshmukh, *et al.* [15].

25% of women presented with oligohydramnios. Frank A manning, *et al.* [16] noted that decreased amniotic fluid volume could be due to chronic intra uterine stress with decreased fetal contribution to the amniotic fluid pool due to uteroplacental insufficiency.

Chamberlain, *et al.* [17] and Bank and Muller, *et al.* [18] Found that decreased amniotic fluid volume significantly increased the risk of FGR.

Total number of live births were 95.83% as compared to 4.16% of still births. Maximum number of babies were low birth weight (47.91%). 27.08% were very low birth weights and 25% were ELBW babies. Similar finding were in Visentin, *et al.* [19] and Mazarico, *et al.* [20].

Adverse perinatal outcome was seen in 52.08% of cases. The gestational age related decrease of S/D, PI and RI indices in the umbilical artery has been reported by many authors and reflect a reduction of flow resistance in the placental villous as the gestation advances.

Arora, *et al.* [21] found that the mode of delivery in patients with abnormal umbilical artery doppler was mainly caesarean section (84.09%). In our study also 87.5% with abnormal Doppler underwent caesarean section.

More number of ELBW and VLBW babies were born to the women with abnormal umbilical artery doppler as compared to women with normal doppler flow. This is an agreement with a comparative study done by Arora, *et al.* [21].

The results of the present study demonstrate the efficacy of doppler in predicting fetal outcome and also highlighted the importance of timely intervention.

50% of neonates with low Apgar score had abnormal doppler findings.

Gravidity	No of women	Percentage
Primigravida	26	54.16%
Multigravida	22	45.83%
Total	48	100%

**Table 1:** Distribution of women according to gravidity.

Gestational age	No of women	Percentage
26-30 weeks	6	12.5%
31-33 weeks	12	25%
34-36 weeks	16	33.33%
>37 weeks	14	29.16%
Total	48	100%

**Table 2:** Distribution of women according to gestational age.

Clinical presentation	Number of women	Percentage
FGR only	8	16.6%
FGR with oligohydramnios	12	25%
FGR with preeclampsia/eclampsia	26	54.16%
FGR with anaemia	20	4.16%
Total	40	100%

**Table 3:** Distribution of women according to clinical presentation.

Doppler	Number of women	Percentage
Abnormal	42	87.5%
Normal	6	12.5%
Total	48	100%

**Table 4:** Findings of doppler examination.

UA	Total	Normal	%	Elevated	%
S/D	48	23	47.91%	25	52.08
PI	48	13	27.08%	35	72.19
RI	48	15	31.25%	33	68.75

**Table 5:** Finding of umbilical artery Doppler examination.

Mean	Total	N	%	Decreased	%
S/D	48	32	66.66%	16	33.33%
PI	48	33	68.75%	15	31.25%
RI	48	25	52.08%	23	47.91%

**Table 6:** Finding of middle cerebral artery doppler examination.

Ductus venosus flow pattern	Number	Percentage
Total	48	100%
Forward	47	97.91%
Reversal flow	1	2.08%

**Table 7:** Doppler examination of Ductus Venosus flow pattern.

Mode of delivery	Number	Percentage
Vaginal	9	18.75%
Caesarean section	39	81.25%
Total	48	100%

**Table 8:** Distribution of women according to mode of delivery.

	Number of women	Percentage
Alive birth	46	95.83%
Still birth	2	4.16%
Total	48	100%

**Table 9:** Distribution according to pregnancy outcome.

Category	Birth weights	Number of neonates	Percentage
ELBW	≤1000	12	25%
VLBW	1001-1500	13	27.08%
LBW	1501-2500	23	47.91%
Total		48	100%

**Table 10:** Distribution of birth weights.

Perinatal outcome	Number of neonates	Percentage
Adverse	25	52.08%
Non -adverse	23	47.91%
Total	48	100%

**Table 11:** Distribution of neonates according to perinatal outcome.

Adverse perinatal outcome	Number of neonates	Percentage
Still birth	2	4-16%
Low apgar score <7 (5min)	2	4-16%
NICU stay >7 days	10	20.83%
Intubated	6	12.5%
Expired	5	10.41%

**Table 12:** Distribution of adverse perinatal outcome.

Mode of delivery and birth weight	Total	Normal Doppler	Abnormal Doppler
LSCS	40	5	35
Vaginal delivery	8	2	6
Total	48	7	41
ELBW (≤1000gm)	12	1	11
VLBW (1001-1500gm)	13	3	10
LBW (1501-2500)	23	5	18
Total births	48	9	39

**Table 13**

Fetal outcome	Total	Normal Doppler	Abnormal Doppler
Low apgar (5min Apgar<7)	2	1	1
Intubated	6	1	5
Still birth	2	0	2
Expired	5	1	4
NICU>7 days stay	10	2	8

**Table 14**

### Conclusion

Doppler provides the first opportunity for repetitive non-invasive haemodynamic fetal monitoring. In FGR fetuses early Doppler changes were seen in umbilical artery followed by centralization of blood flow. Ductus venosus Doppler changes were late changes and indicate severe fetal compromise. Doppler thus helps to optimize the timing of delivery.

To protect fetuses from sudden demises in a hostile intrauterine environment premature termination of pregnancy had to be done. In this study resulting in a tremendous increase in caesarean section rate and premature births that needed NICU care and ventilatory support.

Doppler reveals hypoxic changes earlier than non-stress test and biophysical profile. Hence growth restricted fetuses with Doppler requires a more vigilant surveillance using multiple testing so as to prolong the pregnancy and to minimize the risk of prematurity.

Thereby concluding that Doppler imaging is the principle surveillance modality and should be used in conjugation with all other testing modalities.

### Bibliography

1. Malhotra N, et al. "Maternal –foetal work up and Management in intrauterine growth restriction". *Donald School Journal of Ultrasound in Obstetrics and Gynecology* 4 (2010): 427-432.
2. "ACOG Practice Bulletin: Clinical Management Guidelines for obstetrician". *Gynaecologists* 95 (2000).
3. Gogat S. "Intrauterine Growth Restriction-Obstetrician's perspective". *International Journal of Diabetes in Developing Countries* 21 (2001): 51-5.
4. ACOG Practice bulletin. Intrauterine Growth Restriction. "Clinical management Guidelines for Obstetrician-Gynaecologists". *International Journal of Obstetrics and Gynaecology* 72 (2001): 85-89.
5. Cunningham GF, et al. *Obstetrics' 20th Edition*. Prentice Hall international chapter 5,7 and 36 (1997).
6. Krishna U and Bhalearao S. "Placental Insufficiency and Foetal Growth Restriction". *Journal of Obstetrics and Gynaecology India* 61 (2011): 505-511.

7. Baschat AA, et al. "Relationship between arterial and venous Doppler and perinatal outcome in Foetal growth restriction". *Ultrasound in Obstetrics and Gynecology* 6 (2000): 407-413.
8. Lulla C and Garg S. "Colour Doppler in IUGR-Where are we and where do we go?" *Journal of Obstetrics and Gynaecology* 60 (2010): 301-311.
9. Tekay A and Campbell S. "Doppler ultrasonography in Obstetrics and Gynaecology". 4th edn; Callen PW; WB Saunders Company (2000): 677-718.
10. David Peleg, et al. "Intrauterine growth restriction. Identification and Management". *American Journal of Obstetrics and Gynaecology* 58.2 (1998): 453-460.
11. Baschat AA and Weiner CP. "Umbilical artery Doppler Screening for detection of small foetus in need of antepartum surveillance". *American Journal of Obstetrics and Gynaecology* 182 (2000): 154-842.
12. FitzGerald DE and Drumm JE. "Non-invasive measurement of human fetal circulation using ultrasound: a new method". *BMJ* 2 (1997): 450-451.
13. Mieko R, et al. "Doppler velocimetry of the fetal middle cerebral artery and other parameters of fetal well-being in neonatal survival during during pregnancies with placental insufficiency". *Revista da Associação Médica Brasileira* 59.4 (2013): 392-399.
14. Danish N, et al. "Assessment of pregnancy outcome in primigravida: comparison between booked and unbooked patients". *Journal of Ayub Medical College Abbottabad* 22.2 (2010): 23-25.
15. Deshmukh A, et al. "Significance of umbilical artery Doppler velocimetry in the perinatal outcome of growth restricted fetuses". *Journal of Obstetrics and Gynaecology* 60.1 (2010): 38-43.
16. Manning FA, et al. "Antepartum foetal evaluation:Development of a foetal biophysical profile". *American Journal of Obstetrics and Gynaecology* 136 (1980): 787-795.
17. Chamberlain PF, et al. "Accuracy of Sonographically estimated fetal weight with and without oligohydramnios. A case control study". *Journal of Reproductive Medicine* 44.11 (1994): 969-973.
18. Banks EH, et al. "Perinatal risks associated with borderline amniotic fluid index". *American Journal of Obstetrics and Gynaecology* 180.6 (1999): 1461-1463.
19. Visentin S, et al. "Neonatal outcome in intrauterine growth restricted and small for gestational age fetuses". *Ultrasound in Obstetrics and Gynecology* 36.1 (2010): 52-67.
20. Mazarico E, et al. "Perinatal outcomes in gestations with intrauterine growth restriction and small for gestational age fetuses". *Ultrasound in Obstetrics and Gynecology* 36.1 (2010): 52-167.
21. Arora D, et al. "Significance of umbilical artery velocimetry in perinatal outcome of growth restricted fetuses". *Journal of Obstetrics and Gynaecology India* 55.2 (2005): 138-143.

**Volume 3 Issue 8 August 2021**

© All rights are reserved by Balpreet Kaur, et al.