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Association of Maternal Factors with Perinatal outcome of Growth Restricted Fetuses: with Reference to Doppler Studies

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Abstract

Context: Fetal Growth Restriction (FGR) is the single largest contributing factor to perinatal morbidity in non-anomalous foetuses. This research was conducted in the Department of Obstetrics and Gynaecology in a tertiary care teaching Hospital which included 100 singleton pregnant women with FGR.

Aims: 1. To evaluate the maternal risk factors as possible contributors to FGR and related perinatal mortality.

2. To establish the decision-to-delivery time interval in growth restricted fetuses in correlation to gestational age and doppler examination.

Methods and Material: Socio-demographic, maternal risk, Diagnosis- delivery interval in FGR and neonatal morbidities were studied. Serial deciding doppler were considered for evaluation of the perinatal outcome and mode of delivery.

Statistical Analysis used: The association between doppler category and maternal risk factors was assessed by Chi-square test. The continuous variables were presented as mean ± standard deviation (SD) and the difference between the means was calculated by student's 't' test.

Results: 76% women suffered concomitant comorbidities which could possibly contribute to the genesis of fetal growth restriction. 38% women had hypertensive disorders of pregnancy. Majority of women with FGR ~ 72% delivered by caesarean section. The doppler findings were abnormal among 60 subjects with preterm intervention and poor perinatal outcome.

Conclusions: Obstetric Doppler has helped in early detection and timely intervention in babies with FGR with significant improvements in perinatal outcomes.

Keywords: Maternal age Weight FGR Birth weight

Key Messages: The relevance of doppler in Obstetrics has shown utmost importance as a diagnostic tool in detection of fetal compromise and aiding for optimization for timing of intervention. This tool of Obstetric doppler has enhanced tremendous surveillance to growth restricted fetuses

Introduction

Fetal growth retardation (FGR) is mainly a pathologic slow-down in the fetal growth pace, resulting in a fetus that is unable to reach its growth potential.[1] The decision to deliver a growth restricted fetus remains a topic of fair discussion. The timing of delivery remains a critical issue, the risk of intrauterine compromise has to be weighed against the potential risks from iatrogenic premature delivery.[2] Obstetric doppler and biophysical profile variables serves the purpose. Therefore, we in the present study evaluated multiple maternal factors as possible contributors to the FGR risk and its relation with antenatal doppler studies, timings of intervention and perinatal outcome.

Materials and Methods

Data was collected by interviewing the participants regarding the basic demographics and obstetric history, and thereby correlated with the findings of serial Doppler examinations. All singleton pregnancies with fetal growth restriction diagnosed on sonography criteria of estimated fetal weight (EFW) <10th centile for that gestational age, delivering in our hospital were considered as study subjects irrespective of the present gestational age and maternal risk factors. Calculation of birth weight percentile was deduced from the standardised birth weight calculators derived from fetal medicine foundation website. The patients underwent serial Doppler assessment with the findings of the first doppler i.e., defining doppler and the result of the last doppler examination prior to delivery i.e., deciding doppler were considered for evaluation of the perinatal outcome, mode of delivery, and thus was given appropriate treatment at every stage of assessment. Decision to deliver them was taken if 1) gestational age of 38 weeks, 2) absent end diastolic flow, reverse end diastolic flow, 3) worsening of maternal condition like HELLP, Imminent eclampsia, uncontrolled hypertension 4) oligohydramnios

Results

Demography

The mean age of participants is 27.84 years. Majority of them were in age group 25- 29 (36%). 40% participants were primigravidae and less than 10% were grandmultipara. 20 participants gave prior history of abortion. 58% of women population belonged to urban domicile. About 64% of women were booked while 25% women were referred from outside hospitals. 20% participants had received treatment for infertility.

Maternal Risk factors

Amongst 100 women with fetal growth restriction, 76% of women suffered concomitant comorbidities. 38% of women had hypertensive disorders of pregnancy followed by anaemia (18%), diabetes (11%) and thyroid disorders in 9% women. There were no comorbidities in 24 % individuals. 30 cases with eclampsia/ impending eclampsia/ severe preclampsia superimposed with chronic hypertension required magnesium sulphate. There were two near miss mortality for HELLP syndrome requiring ventilation and ICU care. 27 on 38 women suffering from hypertensive disorders of pregnancy had abnormal doppler findings. Similarly, 12 on 18 women with anaemia had abnormal doppler readings. (Figure 1) There were 5 women requiring blood transfusion for severe anaemia. 15 women out of 24 with no known maternal comorbidities were found to have deranged doppler findings.

Decision - Delivery Delay

FGR was diagnosed in 68% during 34-36.6 weeks of gestation (late preterm) followed by 13% as early preterm (31-33.6 weeks). There were 12% FGR diagnosed in more than 37 weeks (term) group. 7

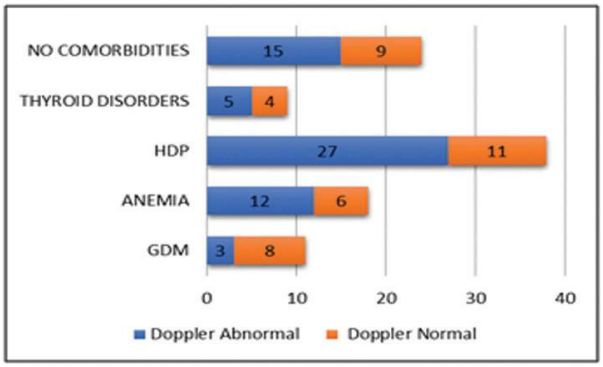

Fig. 1: Doppler abnormalities with medical disorders

extreme preterm babies diagnosed as <30.6 weeks delivered as emergency due to reversal/ absent end diastolic flow. About 45% of women were delivered within 48 hours of diagnosis, 25% delivered in 3-7

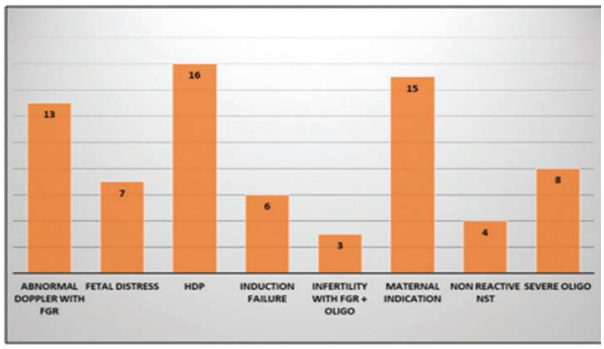

Fig. 2: Indication for Cesarean Delivery

days. In 30% women, decision of delivery was delayed due to normal doppler parameters and good in utero surveillance.

Mode of delivery

(Figure 2) Among the mode of delivery, majority of women with FGR ~ 72% delivered by caesarean section. Maternal indication for caesarean section was noted in 29.16 % reasons pertaining such as cephalopelvic disproportion, previous caesarean, unfavourable cervix, failed induction. 22.22% women were terminated for maternal reason with severe preclampsia, eclampsia and HELLP. Fetal indications were seen in 48.6 % women presenting with fetal distress, non-reactive NST, severe oligohydramnios or abnormal doppler velocimetry. Incidence of PROM added to the incidence of caesarean sections. Emergency caesarean sections were 56%. The indications for caesarean sections are listed in the bar diagram below.

Doppler evaluation

60% population detected with fetal growth restriction had abnormal doppler readings as tabulated below (Table 1).

Neonatal characteristics: Neonatal ICU admission was needed in 52 neonates. Need to resuscitate with ventilator and CPAP in 7 neonates. Neonatal morbidity was grouped in terms of duration of stay in NICU. (Table 2) Neonatal morbidity is tabulated as shown. (Table 3)

Table 1: Doppler abnormalities (n=60)

Doppler abnormality	Frequency (n)	Percentages (%)
Absent end diastolic flow	7	11.7
Brain sparing effect	17	28.3
Diastolic notching	1	1.7
Fetoplacental insufficiency	19	31.7
Reversal of CPR	1	1.7
Reversal of end diastolic flow	4	6.7
Uteroplacental insufficiency	11	18.3
Total	60	100.0

Table 2: Duration of NICU stay

	Frequency (n)	Percentages (%)
<15 days	7	13.5
> 1 month	34	65.4
15-30 days	11	21.2
Total	52	100.0

Table 3: Distribution of neonatal morbidity

	Frequency (n)	Percentages (%)
Hyperbilirubinemia	2	4.8
Hypoglycemia	3	7.1
Necrotizing enterocolitis	6	14.3
Prematurity	17	40.5
Respiratory distress syndrome	6	14.3
Retinopathy of prematurity	1	2.4
Secondary apnoea	1	2.4
Sepsis	6	14.3
Total	42	100.0

Statistical Inference with Doppler velocimetry: There is no statistically significant difference in mean gestational age at diagnosis, at delivery, birth weight and duration of NICU stay with the variations in doppler velocimetry.

Existence of maternal comorbidities does not show any statistical significance with normal or abnormal doppler velocimetry. (Table 4)

Table 4: Comparison of GA at diagnosis & delivery, birth weight and duration of NICU stay between Doppler Abnormal and Normal Group

	Doppler	N	Mean	SD	p-value
Gestational age at diagnosis	Abnormal	60	34.91	2.95	0.37
	Normal	40	35.46	2.99	
Gestational age at delivery	Abnormal	60	36.22	2.72	0.88
	Normal	40	36.31	3.14	
Birth Weight	Abnormal	60	1938.47	560.53	0.08
	Normal	40	2136.38	537.06	
Duration of NICU stay	Abnormal	33	31.06	13.48	0.97
	Normal	19	30.89	14.41	

Variables for fetal surveillance like Amniotic fluid index (AFI), Non stress test (NST) and compounding markers like NICU stay are placed on multivariate regression analysis, and compared with normal and abnormal doppler. There is no such significant corelation established.

Table 5: Association between Maternal Risk Factors and Doppler Category

		Doppler		Total	Chi-Square Value	p-value
		Abnormal	Normal			
GDM	Yes	3	8	11	5.51	0.019*
	No	57	32	89		
Anaemia	Yes	12	6	18	0.41	0.52
	No	48	34	82		
Thyroid Disorders	Yes	5	4	9	0.081	0.99
	No	55	36	91		
Co-morbidities	Yes	45	31	76	0.082	0.77
	No	15	9	24		
HDP	Yes	27	11	38	3.12	0.077
	No	33	29	62		
Gestational Age at Diagnosis	Extreme Preterm	8	4	12	1.82	0.61
	Early Preterm	5	3	8		
	Late Preterm	32	18	50		
	Term	15	15	30		
Gestational Age at Delivery	Extreme Preterm	2	4	6	3.27	0.35
	Early Preterm	6	2	8		
	Late Preterm	20	10	30		
	Term	32	24	56		

Discussion

Fetal growth restriction (FGR) is most often defined as "an estimated fetal weight less than the 10th percentile for gestational age by prenatal ultrasound evaluation."[3] However, some fetuses are considered constitutionally small having low birth weight less than 10th percentile for their gestational age. They are categorised as small for gestational age fetuses instead of labelling them as growth restricted fetuses.

FGR affects about 3% to 7% of all pregnancies.[7] It is the common end result of maternal, placental, fetal, or genetic factors, and FGR can also result due to a combination of any of these factors. Various maternal factors such as age of the mother, inter-pregnancy interval (less than 6 months or 120 months or more), maternal health, behavioural habits, and maternal infection affect the growth of the fetus and are responsible for causing FGR.5

FGR increases the risk for intrapartum asphyxia, preterm delivery, respiratory distress syndrome, sepsis, seizures, intraventricular haemorrhage, and necrotizing enterocolitis. Effects of FGR often affect childhood and adult life, as well. This research has urged the need of improvised antenatal surveillance to prevent such a dramatic imposition on the maternal and neonatal health draining the financial and psychological burden in an individual life.

The study initiated from the detailed maternal history, associated genetic/ acquired risk factors, BP monitoring at every visit, serial doppler and biophysical profile assessment for fetal status and worsening doppler parameters, administration of Tablet Ecosprin, steroids as per guidelines has improved the prognosis. Amongst 100 women with fetal growth restriction, 76% of women were identified to have concomitant comorbidities. Tactful monitoring with multidisciplinary approach is the key in growth restricted fetuses. In 30% women, decision of delivery was delayed due to normal doppler parameters and good in utero surveillance. Term FGR had shorter NICU stay and

Table 6: Multivariate Logistic Regression Analysis

Variables		Doppler		Total	AOR (95%CI)	p-value
		Abnormal	Normal			
AFI	<5	8	9	17	0.32 (0.10-1.06)	0.06
	>15	1	2	3	0.77 (0.03-22.14)	0.88
	5-15	51	29	80	1	
NST	Non-Reactive	2	2	4	2.01 (0.21-19.28)	0.55
	Reactive	58	38	96	1	
NICU admission	Yes	33	19	52	0.90 (0.34-2.39)	0.84
	No	27	21	48	1	
EFW Centile	≤3	44	20	64	3.47 (1.26-9.57)	0.02*
	>3	16	20	36	1	
HDP	Yes	27	11	38	1.59 (0.54-4.69)	0.40
	No	33	29	62	1	
GDM	Yes	3	8	11	0.21 (0.04-1.15)	0.07
	No	57	32	89	1	
Anaemia	Yes	12	6	18	1.64 (0.48-5.55)	0.43
	No	48	34	82	1	
Thyroid disorders	Yes	5	4	9	0.94 (0.20-4.42)	0.93
	No	55	36	91	1	

early preterm had longer NICU stay due to neonatal morbidities necessitating prolonged intensive care.

7 extreme preterm babies diagnosed as <30.6 weeks delivered as emergency due to reversal/ absent end diastolic flow, where neonates required NICU stay > 1 month.

Conclusion

Growth restriction in itself compounds with multiple maternal high-risk factors, including preclampsia, anaemia, increasing incidence of low birth babies and perinatal morbidity. Obstetric doppler surveillance has allowed the culmination of a structured antenatal and neonatal period, benefiting both the mother and neonate into a healthy adulthood.

However, there is depiction of the rising trend of caesarean section with parallel rising detection of doppler abnormalities. But it is to be disclaimed that this is a small population study and further research is mandated to establish better accuracy for prediction of composite adverse perinatal outcome.

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Conflict of Interest: None

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