Original Research Article

Role of Doppler Ultrasound in Prediction of Perinatal Outcome in Intra Uterine Growth Retardation

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Abstract

Background: Umbilical artery Doppler blood flow studies are improved interpreter of neonatal outcome than estimated fetal weight alone in intrauterine growth restricted (IUGR). Perinatal mortality and morbidity are increased if the umbilical artery Doppler ultrasound abnormality worsens.
Materials and methods: This study was conducted in Department of Obstetrics and Gynecology in a Tertiary Care Hospital for a period of 1 year (August 2018 to July 2019). One hundred singleton pregnancies complicated by IUGR beyond 32 weeks were subjected for Doppler study. Perinatal outcome in terms of baby outcome, birth weight, early neonatal death, admission in NICU and duration of admission in NICU were analyzed. SPSS Version 22 was used for analysis.
Results: The main warning of termination of pregnancy was oligohydramnios (75%). Other causes were 10% for uncontrolled hypertension and 6 % for post term. 50% were delivered vaginally and 50% by lower segment cesarean section. Birth weight of the babies varied from 800gm to 2.5 kg. Perinatal mortality in our study was 20% which includes 9% of intrapartum mortality and 11% of neonatal mortality and perinatal morbidity was 24%.
Conclusions: The results of present study clearly demonstrated the efficacy of umbilical artery Doppler ultrasound in predicting the fetal outcome. To improve the predictive value of this tool, a better method is needed to assess the wellbeing of the IUGR fetuses must be employed.

Key words

Intra Uterine Growth Retardation, IUGR, Perinatal mortality and morbidity, Oligohydramnios, LSCS, Doppler ultrasound, Still born.

Introduction

Intra Uterine Growth Restriction (IUGR) is defined as estimated fetal weight less than 10th percentile for that gestational age. Growth of the fetus rest on the genetic potential which is determined by maternal and paternal genetic makeup and supply to the fetus. Incidence of IUGR is 3-10% of all pregnancies upon the diagnostic criteria used. 1At any gestational age, infants with low birth weight have relatively high morbidity and mortality [1, 2]. Low birth weight babies are susceptible to for fetal demise, birth asphyxia, meconium aspiration, hypoglycemia, hypothermia, respiratory distress syndrome. There is strong association between IUGR and later development of metabolic syndrome comprising of arterial hypertension, coronary artery heart disease, dyslipidemia, visceral obesity, impaired glucose tolerance and Type 2 diabetes mellitus [3]. Confirmation of IUGR is done with two dimensional ultrasonogram. When the abdominal circumference is less than 5th percentile or estimated, fetal weight is less than 10th percentile IUGR is diagnosed with certainity. Doppler blood flow studies were a better predictor of neonatal outcome than estimated fetal weight alone [4, 5]. It is non-invasive and is capable if depicting the hemodynamic changes occurring in fetuses. Since there are lacunae in literature in this region Doppler velocimetry not only decides the optimum time of delivery but also the optimum mode of delivery.

Materials and methods

A prospective analytical study was conducted in Department of Obstetrics and Gynecology at Tertiary Care Hospital from August 2018 to July 2019. 100 singleton pregnancies complicated by intrauterine growth restriction beyond 32 weeks were included in the study. Multiple pregnancies, patients with irregular menstrual cycles without dating scan in the first trimester and intra uterine growth restriction complicated by abruption placenta and uterine rupture were excluded from the study. Toshiba Nemio colour Doppler machine was used for this study. Curvilinear probe with 3.5MHz was used.

Demographic details of patients and details of last menstrual period and high-risk factors in current pregnancy like chronic hypertension, gestational hypertension, renal disease, collagen vascular disease, thyroid disorders, anemia, heart disease were noted. If on abdominal palpation growth lag of 4 weeks between gestational age and uterine fundal height is noted, IUGR is suspected and these patients were subjected for two dimensional ultrasonogram. Fetal biometry including Biparietal diameter (BPD), Head circumference, Abdominal circumference (AC) and Femur length (FL) were noted. Estimated fetal weight is calculated by using Haddlock formula by an in built software in the ultrasound machine.

Using percentile charts intrauterine growth restricted fetuses were identified when the abdominal circumference is less than 5th percentile and the estimated fetal weight is less than 10th percentile for that gestational age. Once IUGR is diagnosed, all patients are subjected for umbilical artery Doppler velocimetry. Umbilical artery RI, PI and S/D ratio were noted down.

Using percentile charts for each index, these IUGR fetuses are categorized into category I, II and III.
Category I - Umbilical artery Doppler indices less than 95th percentile for that gestational age.
Category II - Umbilical artery Doppler indices more than 95th percentile for that gestational age. But umbilical artery had forward diastolic flow.
Category III - Absent diastolic flow or reverse end diastolic flow.

The mode of delivery, birth weight of the baby, APGAR at 1 and 5 minutes, admission in NICU were noted. Still born fetuses and fetuses who dies in early neonatal period were also noted.

Results

As per **Table – 1**, doppler ultrasound showed among 100 patients 57% were born normally and 43% were born as IUGR which is quite high. Among the categories described 43% was further split into two categories as 30% and 13%. Which was distinguished based on absent diastolic flow.

Table – 1: Number and Grading of IUGR cases according to Doppler studies.

IUGR cases	Number (%)
Normal	57 (57)
Abnormal	43 (43)
Categories	
I	57 (57)
II	30 (30)
III	13 (13)

According to **Table – 2**, in category I and II the main indication for termination of pregnancy was oligohydramnios (75%). 10% was terminated because of uncontrolled hypertension and 4% were terminated for post term. In the category III group, absent diastolic flow in the umbilical artery was the indication for 2%.

Birth weight of the babies varied from 800 gms-2.5 kgs. 62.7% of category I and 28.6% of category II, baby weight was more than 2kg. In category III, none of the baby's birth weight was more than 2 kg and 80% of babies weighed less than 1.5 kg (**Table – 3**).

There were about 11% early neonatal death in the NICU. The causes were attributed to necrotizing enterocolitis, Intraventricular hemorrhage and hypoxic ischemic encephalopathy. Overall 80% of the category III group had poor perinatal outcome either as still birth or as early neonatal death. Neonatal morbidity in terms of admission in the NICU and duration of admission in NICU were shown. Totally 26 babies were admitted in NICU (15% of category I, 7% of category II and 4% of category III). Varying reason for admission were hypoxic ischemic encephalopathy, respiratory distress, necrotizing enterocolitis, hypoglycemia, meconium aspiration syndrome and hyperbilirubinemia (**Table – 4)**.

Table – 2: Indication for Termination.

Indication	Category I	Category II	Category III
Oligohydramnios	55	20	
Uncontrolled HTN	5	4	1
Post term	1	3	
Eclampsia	1		
Gestational HTN	3	2	1
HELLP	3	1	

Table – 3: Birth Weight of Study Group category wise.

Birth Weight (kg)	I	II	III
<1.5	6	6	6
1.5-2.5	16	6	6
>2.5	35	18	1

Table – 4: Neonatal Morbidity category wise.

Admission to NICU	I	II	III
1-4 days	13	4	2
5-7 days	2	2	1
>7 days		1	1

Table – 5: Perinatal Outcome among the study subjects based on Doppler ultrasound.

Doppler	Adverse	Good
Abnormal	33	10
Normal	17	40

Table – 6: Perinatal Outcome Category wise.

Outcome	I (57)	II (30)	III (13)
Still born	1	2	3
Early neonatal death	5	6	4
Perinatal mortality	8%	26%	85%
Perinatal morbidity	20	15	1
Adverse Outcome	26	23	8

Though IUGR fetuses were diagnosed with two dimensional ultrasonogram, it does not predict the perinatal outcome. Hence these IUGR fetuses were analyzed with umbilical artery Doppler ultrasound. Abnormal showed 33% has adverse effect. 40% Normal showed good Doppler (**Table – 5**).

Overall perinatal mortality in our study was 20% which included 9% of intrapartum mortality and 11% of neonatal mortality. Perinatal morbidity was 24% (**Table – 6**). This is in accordance with Deshmukh, et al. [8] study where perinatal mortality and morbidity were 18% and 49%. Perinatal mortality is higher in absent or reverse diastolic flow group in Category III.

Discussion

The present was planned to determine the IUGR and Perinatal outcome in the present study. Mean gestational age when the patients were diagnosed as IUGR was 36.8 weeks. In the study population patients with lesser gestational age (<32weeks) with IUGR were excluded in order to avoid the influence of preterm birth in perinatal morbidity and mortality. In present study, 8% of category II and 2% of category III patients had gestational hypertension as a risk factor. Bynn YJ, et al.; Sharma U, et al. studies showed gestational hypertension as a predisposing factor for 30% patients [6, 7]. In Deshmukh A, et al. study 78.6% of low diastolic flow patients and 82.35% of absent /reverse diastolic flow patients were predisposed by hypertensive disorder [8]. 75%

patients have oligohydramnios as the indication of termination. Deshmukh A, et al. reported that 64.30% of low diastolic flow group and 82.35% of ADF/RDF group had oligohydramnios [8]. In present study, 20% of category II had oligohydramnios. In category III patients 70% had absent diastolic flow and 30% had reversal of flow and pregnancy was terminated. In present study, 50% delivered vaginally and 50% were taken up for LSCS. In category I 52.5% delivered vaginally and 47.5% delivered by LSCS. In other categories vaginal delivery is the primary mode of delivery. In category II, 69.5% and in category III, 90% delivered vaginally. Overall perinatal mortality in our study is 19% which includes 8% of intrapartum mortality and 1% of neonatal mortality. Perinatal morbidity is 24%. This is in accordance with Deshmukh et al study where perinatal mortality and morbidity were 18% and 49% [8]. Perinatal mortality is higher in absent or reverse diastolic flow group. When the diastolic flow in the umbilical artery is absent or reversed, it is associated with increased perinatal mortality. Mortality rate was 100% in Narulla H, et al.; Lakhar BN, et al.; Mohamed K, et al. study [9, 10, 11]. Bhatt, et al. reported 50% mortality [12]. In this current study 80% perinatal mortality occurred in category III. In category II, the perinatal mortality was 20%. Unless the change in the diastolic flow of the umbilical artery was followed up in category II the mortality rate would have reached higher rate as in absent or reversed group. In category I, above said studies were in favour of good

perinatal outcome with 100% negative predictive value, in present study these patients also had adverse perinatal outcome in both mortality (7.5%) and morbidity (23.9%) [13]. Cochrane database systematic review (2000) in high risk pregnancies concluded that, the use of Doppler ultrasonogram in high risk pregnancies appear to improve several obstetric outcomes and appears promising in helping to reduce perinatal death [14].

Conclusion

The results of the present study clearly demonstrated the efficacy of Doppler ultrasound in predicting the fetal outcome. Identifying intra uterine growth restricted fetuses due to uterplacental insufficiency is helpful in planning the antenatal fetal surveillance. Umbilical artery Doppler study identifies the changes in the umbilical artery which in turn predicts the resistance offered. Hence Doppler ultrasound is one of the effective tool for doing antenatal fetal surveillance in IUGR fetuses.

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