



ABNORMAL UMBILICAL ARTERY VELOCIMETRY AND NEONATAL OUTCOME

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FEDF- forward end diastolic flow; AREDF- absent or reversal of diastolic flow; NICU- Neonatal Intensive Care Unit; IUGR-Intrauterine

ABSTRACT

Background: Umbilical doppler pattern is one of the most widely used test to assess placental blood flow. In Umbilical artery doppler studies placental vascular insufficiency is reflected as abnormal diastolic flow. Absent or reversed diastolic flow is associated with fetal hypoxia and acidosis which need immediate termination of pregnancy, thus increasing caesarean sections and also prematurity related complications.

Methods: This prospective cohort study was conducted in the Departments of Obstetrics and gynaecology & Paediatrics, Govt Medical College, Thrissur from February 2014 to December 2014. Neonatal outcome of babies of 201 antenatal mothers with singleton pregnancies diagnosed with abnormal umbilical artery Doppler flow were studied till postnatal day 28 or till the date of hospital discharge whichever is later. The maternal and neonatal characteristics were compared between the reduced diastolic flow group forward end diastolic flow, FEDF] and absent or reversal of diastolic flow group [AREDF]. Babies with major malformations were excluded while comparing the neonatal outcome.

Results: All neonates with AREDF group needed NICU admission but only 50% of FEDF needed NICU admission. Mean duration of NICU stay in AREDF group was 20 days when compared to FEDF group, which was 7days. Incidence of prematurity, IUGR (intrauterine growth restriction) and low birth weight were significantly higher in AREDF group when compared to FEDF group. Mean birth weight is significantly low in AREDF group (1.141 kg) when compared to FEDF group (1.96kg); p value 0.000). Perinatal asphyxia was higher in AREDF group when compared to FEDF group (1 minute apgar.3.88; vs 8.29; p value 0.000). There were 44.1% still birth in AREF (FEDFgroup; 1.2%; p value 0.000) and 17.6% neonatal death in ARED flowgroup. (FEDF group; 6.1%; p value 0.000). Only 3(23%) babies with reversal of diastolic flow survived. Prematurity related complications like HMD (hyaline membrane disease), apnoea of Prematurity, feed intolerance, NEC (necrotising enterocolitis) were higher in AREDF group and it was statistically significant. Absent or reversal of end diastolic flow was more in those mothers with preeclampsia and this difference was statistically significant. **Conclusions:** Doppler velocimetry is a noninvasive and safe imaging modality of indirectly assessing the fetal and uteroplacental circulation and plays an important role in detecting Intra Uterine Growth Restriction (IUGR). It helps in timely intervention balancing prematurity and intrauterine death. AREDF directly correlates with NICU admission.

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INTRODUCTION

Intrauterine growth restriction (IUGR) is a major and silent cause for morbidity and mortality in the neonatal period.(1) Low birth weight is common in India and varies from 15-25%. Of these more than 50% is due to intrauterine growth restriction (IUGR). Although the incidence of IUGR in western world is 8%, the prevalence in developing world is much higher at ~35%(2). Though there are multiple maternal conditions causing IUGR, placental vascular insufficiency (75-80%) is the major reason(3). Umbilical doppler pattern is one of the most widely used test that reflects the status of placental circulation. In Umbilical artery doppler studies placental vascular insufficiency is reflected as abnormal diastolic flow. Absent or reversed diastolic flow is associated with severe intrauterine growth retardation, oligohydramnios, fetal hypoxia and acidosis which need

immediate termination of pregnancy, thus increasing caesarean sections and prematurity and also prematurity related complications. Perinatal asphyxia is the most important complication associated with IUGR due to placental insufficiency.

A number of observational studies have reported the outcome of IUGR infants with abnormal Doppler flow pattern. However there are only few studies in developing countries regarding the same(2). This study is designed to find the immediate neonatal outcome (till postnatal day 28 or till the time of discharge from hospital, whichever is later) of babies born to mothers with abnormal umbilical artery doppler. Maternal and neonatal characteristics were compared between those with reduced diastolic flow [named as forward end diastolic flow group, FEDF group] and those with absent or reversal of diastolic flow [AREDF group]

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METHODS

All antenatal mothers with suspected intrauterine growth restriction on routine antenatal check up during the period from February 2014 to December 2014, were subjected for doppler study in the Department of Radiology. Imaging was done by HP image point color Doppler machine with convex probe 3.5 MHz. Fetal biometry and morphology scan was done. The Doppler parameters in fetal umbilical artery were studied. Abnormal umbilical artery doppler is defined by the presence of any of the three features 1) reduced diastolic flow 2) absent end diastolic flow 3) reversal of diastolic flow. Those 201 mothers admitted in labour room, with abnormal umbilical artery doppler during the study period were selected. Informed written consent was taken. A proforma regarding maternal details were collected. Gestational age was calculated based on first trimester ultrasound scan and mothers LMP. (last menstrual period)

Neonatal outcomes were followed up in terms of perinatal mortality, birth weight, incidence of perinatal asphyxia, need for NICU (Neonatal Intensive Care Unit) admission, prematurity, respiratory distress syndrome, need for ventilator support, duration of ventilator support, metabolic abnormalities like hypoglycaemia, NEC (Necrotising enterocolitis), incidence of sepsis, feed intolerance and duration of hospital stay. Babies were followed up for a period of 28 days or till the date of discharge. The overall maternal characteristics, maternal risk factors and neonatal outcomes were analysed in the study group.

Statistical analysis

Collected data was coded and entered in Microsoft excel. Analysis done using SPSS-16. Qualitative data was analysed using proportions. Quantitative data analysed using mean and standard deviation. Difference between means were analysed using independent t test. The significance level was kept at 5% level

RESULTS

There were total of 201 pregnant mothers with abnormal umbilical artery doppler flow velocimetry. They were divided into two groups, one with reduced diastolic flow (FEDF GROUP=167) and other with absent or reversal of end diastolic flow velocity (AREDF GROUP=34).

Mean maternal age was higher in AREDF group when compared to FEDF group (Table 1)

Table 2 Maternal and foetal characteristics of in FEDF group and AREDF group

Variables	FEDF *(167)	AREDF†(34)	P value
Mean age with SD	25.3 (5.38)	26.85 (4.698)	0.093
Preeclampsia	47 (25.2%)	21(70.7%)	0.001
IUGR	146 (87.4%)	34 (100%)	0.101
Oligamnios	90(53.9%)	29 (85.3%)	0.001
Gestational age	35.95(2.24%)	32.638 2.5%)	0.00
Birth weight with SD	1.96 (0.58)	1.141 (0.51)	0.00
1 minute apgar	8.29 (1.91)	3.88 (3.8)	0.00
Stillbirth	2 (.2%)	15 (44.1%)	0.00
Neonatal Death	10 (6.1%)	6 (17.6%)	0.00

FEDF *Forward End Diastolic flow, AREDF†Absent or Reversal of Diastolic flow

Absent or reversal of end diastolic flow was more in those mothers with preeclampsia and this difference was

statistically significant. IUGR babies are higher in AREDF group when compared to FEDF group but it is not statistically significant. Oligamnios is significantly higher in AREDF group when compared to FEDF group. Only 5 babies in AREDF group did not have oligamnios. Prematurity is significantly high in AREDF group when compared to FEDF group. Mean birth weight is also significantly low in AREDF group when compared to FEDF group. Perinatal asphyxia is significantly higher in AREDF group when compared to FEDF group. There were 44.1% still birth and 17.6% neonatal death in ARED flowgroup.

Comparison of neonatal outcome in FEDF group and AREDF group are shown in (Table 2). Total NICU admissions were 102. Still born babies (2 still birth in FEDF group and 15 in AREDF group) were not admitted in NICU. This include 83/ 165 in the FEDF group and 19/19 in the AREDF group. All newborns in AREDF group needed NICU admission. Duration Of NICU Stay was significantly longer (19.5 days SD 16.6) in AREDF group when compared to FEDF group (Mean 7.22 SD 10.3) p 0.001 The incidence of VLBW (very low birth weight), preterm IUGR, HMD (hyaline membrane disease), Hypoglycemia, Feed intolerance, Necrotising Enterocolitis, Sepsis and jaundice were significantly high in the AREDF group when compared FEDF group. But statistically significant increase was not seen in the incidence of IVH (intraventriculae haemorrhage), Pulmonary haemorrhage and polycythaemia.

Table 1 Comparison of Neonatal outcome in FEDF group and AREDF group

Outcome variables	FEDF * group(n=165)		AREDF† group(n=19)		P	Chi-square
	Frequency	Percentage	Frequency	Percentage		
Preterm IUGR‡	54	33.5	14	73.7	0.01	13.22
ELBW§	6	3.7	8	42.1	0.000	45.17
RDS¶, or HMD#	7	4.3	4	21.1	0.002	9.723
Surfactant Use	7	4.3	4	21.1	0.002	9.7
Ventilator Support	10	6.2	6	31.6	0.000	13.5
IVH**	1	0.6	1	5.3	0.068	3.33
Pulmonary Haemorrhage	2	1.2	1	5.3	0.195	1.677
Hypoglycemia	25	15.5	8	42.1	0.000	18.66
Feed Intolerance	36	22.4	14	73.7	0.000	25.142
Necrotising Enterocolitis	27	16.9	11	57.9	0.000	28.66
Sepsis	13	8.1	5	26.3	0.021	7.725
Polycythemia	8	5	3	15.8	0.08	5.04
NNJ††	71	44.1	16	84.2	0.000	19.7
AOP‡‡	5	3.1	6	31.6	0.00	24.01
NICU§§ Admission	83	50.3	19	100	0.00	68.7

FEDF *Forward End Diastolic flow; AREDF† Absent or Reversal of Diastolic flow; IUGR‡ Intrauterine Growth Restriction; ELBW§ Extremely Low Birth Weight; RDS¶, respiratory Distress Syndrome; HMD# Hyaline Membrane Disease; IVH** Intraventricular Hemorrhage; NNJ†† Neonatal Jaundice AOP‡‡ Apnea of prematurity, NICU§§ Neonatal Intensive Care Unit

DISCUSSION

When the neonatal outcome was compared between FEDF and AREDF group, AREDF group is found to have significantly increased morbidity and mortality compared to FEDF group, which is comparable with the previous studies (4).

Incidence of prematurity, IUGR and low birth weight were significantly higher in AREDF group when compared to FEDF group which is also comparable with previous studies

(4). The high incidence of prematurity may be due to early termination of pregnancy. In a study by Arora there were 85% premature babies in AREDF group when compared to 43% in FEDF group (5). The mean birth weight also less (1.14kg) in AREDF group due to prematurity and intrauterine growth restriction.

All neonates with AREDF group needed NICU admission but only 50% of FEDF needed NICU admission. So AREDF directly correlates with NICU admission. In a study by Arora *et al* the rate of NICU admission was 100% in AREDF group and 70% in FEDF group. Perinatal asphyxia was significantly higher in AREDF group (5). There were 44% still birth and 17.6% neonatal death in AREDF group. Since our institution is a tertiary care centre most of the mothers are referred here after detecting the abnormality in Doppler. So the delay in termination of pregnancy may be the reason for increased still birth in AREDF group. Only 3(23%) babies with reversal of diastolic flow survived.

Prematurity related complications like HMD, apnoea of Prematurity, feed intolerance, NEC were higher in AREDF group and it was statistically significant which is comparable with previous studies (6). But in our study the incidence of NEC was very high when compared to previous studies (6). IUGR related complications like hypoglycaemia, polycythaemia were higher in AREDF group.

Incidence of hypoglycaemia was significantly higher in our study when compared to previous studies (4). According to Mccawan, hypoglycaemia in neonates was found to be dependent on the birth weight and not on abnormal umbilical artery Doppler findings (7). Incidence of culture proven sepsis was low in our study when comparing to other studies (6), probably due to reduced yield or due to early introduction of antibiotic in suspected case of sepsis.

AREDF group had higher incidence of (neonatal jaundice) NNJ [84%], when compared to FEDF group. Mean duration of NICU stay in AREDF group was 20 days when compared to FEDF group, which was 7 days. The mean duration of NICU stay was also similar to study by Arora *et al* (5). There was no significant incidence of neonatal haemorrhage [IVH and pulmonary haemorrhage] between the two groups. Baschat *et al* in 2002 in their study concluded that no doppler parameter was identified as an independent contributor to intraventricular haemorrhage (8).

CONCLUSIONS

Doppler velocimetry is a noninvasive and safe imaging modality of indirectly assessing the fetal and uteroplacental circulation and plays an important role in detecting Intra Uterine Growth Restriction (IUGR). It helps in timely intervention balancing prematurity and intrauterine death. Women with history of adverse obstetric outcome in the previous pregnancy are more likely to have IUGR babies with abnormal umbilical artery Doppler flow in the next pregnancy. Admission to the NICU and incidence of perinatal morbidity and mortality increased with the worsening of doppler velocimetry. AREDF group is found to have significantly increased morbidity and mortality when compared to FEDF group. Perinatal asphyxia was significantly higher in AREDF group.

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