

Efficacy of Umbilical Artery Doppler in Detection and Management of Intrauterine Growth Retardation

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ABSTRACT

Objective: To evaluate the efficacy of doppler flow study in umbilical artery in the diagnosis and management of fetal growth retardation in small for gestational age fetuses detected by clinical examination.

Study Design: Descriptive case series.

Place and Duration of Study: This study was conducted at the Department of Obstetrics & Gynecology, Nishtar Hospital Multan from September 20, 2007 to June 19, 2008.

Subjects and Methods: Subjects were selected from clinically diagnosed pregnant ladies visiting antenatal clinic or admitted in labour. Umbilical artery doppler flow study was done and perinatal outcome was assessed. On the basis of umbilical artery doppler flow study, the subjects were categorized into abnormal (group A) or normal (group B). Perinatal outcome of both these groups was compared on the basis of criteria mentioned in the proforma.

Results: Out of 50 patients, 21 (42%) patients were having abnormal umbilical artery doppler flow study (Group A) and 29 (58%) patients were having normal umbilical artery doppler flow study (Group B).

Emergency cesarean section, Preterm delivery, Low birth weight, admission of newborn to nursery, Low Apgar score (≤ 5) and Early neonatal death were significantly more in group A versus group B.

Conclusion: There is a correlation between umbilical doppler velocimetry and an increased incidence of perinatal complications in intrauterine growth retarded fetuses.

Key Words: Umbilical Artery Doppler (UAD), Intrauterine growth restriction (IUGR), Small-for-gestational-age (SGA)

INTRODUCTION

Doppler ultrasonography is a non invasive test that can be used to evaluate blood flow in vessels¹. The intrauterine growth restriction (IUGR) is the second leading contributor to prevailing perinatal mortality and morbidity. It effects 23.8% of newborn around world and 75% of these affected infants are born in Asia. In Pakistan the incidence of IUGR is around 25%².

The use of doppler ultrasound has allowed the identification of abnormal patterns of resistance to blood flow in specific fetal vessels including the umbilical artery (UA), middle cerebral artery and ductus venosus³.

The flow in the umbilical arteries is characterized by continuous forward flow typical of a low resistance circuit. As gestational age increases there is a gradual fall in the resistance indices due to enlargement of placenta with corresponding expansion of its vascular tree⁴. A reduction in end-diastolic velocity suggests increase resistance to blood flow originating in the placenta and this pattern is seen in pregnancies complicated by fetal growth retardation⁵. There is an eight fold increase in the perinatal mortality of small-for-gestational-age (SGA) neonates as compared with normally grown fetuses.

This study was designed to evaluate the efficacy of doppler flow study in umbilical artery in diagnosis of fetal growth retardation. Thus in clinically diagnosed

small for gestational age fetuses, doppler ultrasonography may help to confirm diagnosis and fetuses may be managed effectively.

MATERIALS AND METHODS

It was a descriptive case series study done in obstetrics and gynaecology department of Nishtar hospital Multan from September 2007 to June 2008. 50 patients with singleton pregnancy having small for gestational age fetuses diagnosed on abdominal examination and having gestation of more than 30 weeks were enrolled for the study. Informed consent was taken. Patients were included in the study with permission of Ethical Committee. Patients with molar pregnancy, multiple gestation, eclampsia or unsure of dates were excluded from the study.

After detailed history, abdominal examination, an obstetric ultrasonography was done to see fetal biometry. First doppler study was done as baseline doppler study in which we categorized the pregnant ladies into four groups. First with normal doppler studies, second with reduced diastolic flow in umbilical artery, third with absent diastolic flow in umbilical artery, fourth with reversed end diastolic flow in umbilical artery.

In first group with normal doppler flow study findings but having small for gestational age singleton pregnancy on clinical assessment, doppler ultrasonography was repeated after 3 weeks. If repeat

doppler study was also normal and growth parameters were increasing along a consistent percentile then no further doppler study was repeated and the fetus was labeled as constitutionally small not as IUGR.

In the second group that had reduced diastolic flow in umbilical artery as detected on baseline doppler study, repeat doppler ultrasound was done 2 weekly. If the diastolic flow on repeat doppler flow study was reduced to the same extent as in the baseline doppler flow study and growth parameters were also increasing but less than expected and if there was no added risk factor such as decreased liquor, pregnancy was allowed to be continued as much as possible near term with close fetal surveillance. But if the diastolic flow was deteriorated on any repeat doppler flow study or growth parameters of the fetus were not increasing or if there was any other risk factor along with deterioration in diastolic flow, immediate delivery was planned.

In the third group having absent end-diastolic flow as detected on baseline doppler flow study and the gestational age was less than 34 weeks, steroids were given to these patients and doppler flow study was repeated on alternate days till 2 weeks to prolong the pregnancy to the extent so that fetus becomes more mature. But if diastolic flow deteriorated on any repeat doppler flow study, immediate delivery was planned.

In patients with absent end diastolic flow as detected by baseline doppler flow study and the gestational age was more than 34 weeks, immediate delivery was planned.

In the fourth group having reversed end-diastolic flow on baseline doppler flow study, immediate delivery was planned.

Perinatal outcome was assessed by emergency cesarean section, preterm delivery, birth asphyxia, admission to newborn nursery, APGAR score, duration of hospital stay of newborn, early neonatal death (within 7 days). Data were entered and analyzed by SPSS version 11. Chi-square test was used to evaluate the effectiveness of doppler USG in the diagnosis and management of two groups of small for gestational age fetuses, one with abnormal doppler and other with normal doppler findings. p-value less than or equal to 0.05 was considered as significant.

RESULTS

Group A was having abnormal umbilical artery doppler patients and group B was having normal umbilical artery doppler patients. Out of 50 patients, 21 patients were having abnormal umbilical artery doppler flow study (Group A) and 29 patients were having normal umbilical artery doppler flow study (Group B) as shown in figure 1.

In group A, 11(52.4%) patients belonged to 21–25 years of age while 9(31.1%) patients in group B belonged to this age group. Seven (33.3%) patients in group A were between 26–30 years and 15(51.7%) patients in group B belonged to this age group. Mean

age \pm S.E. was 26.67 ± 0.70 vs 25.45 ± 0.70 in group A and B respectively.

Mean gestational age \pm S.E. of the patients was 35.52 ± 0.64 vs 36.79 ± 0.55 in group A and B respectively.

Perinatal outcome of both these groups was compared on the basis of emergency cesarean section, preterm delivery (<34 weeks gestation), low birth weight (<2.5 kg) admission to nursery, low Apgar score (≤ 5), hospital stay of newborn more than 7 days, early neonatal death (within 7 days).

In group A, emergency cesarean section was done in all 21(100%) patients, while in group B, emergency cesarean section was done in 17(58.6%) out of 29 patients. In group A, rate of preterm delivery (< 34 weeks) was 52.3% while it was 31% in group B. In group A, 12(57.1%) out of 21 newborns were of low birth weight (<2.5 kg) while in group B, only 3(10.4%) out of 29 newborns were of low birth weight.

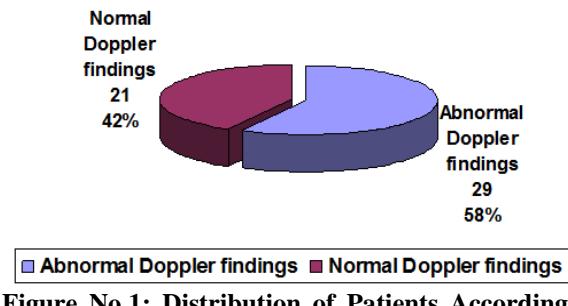


Figure No.1: Distribution of Patients According to Umbilical Artery Doppler Findings (n=50)

Table No.1: Perinatal Assessment

Complication	No. of Patients	
	Abnormal Doppler Findings (n=21)	Normal Doppler Findings (n=29)
Emergency cesarean section	21(100.0%)	17(58.6%)
Preterm delivery	11(52.3%)	9(31.0%)
Low birth weight	12(57.1%)	3(10.4%)
Admission to nursery	17(80.9%)	9(31.0%)
Low Apgar score	15(71.4%)	7(24.1%)
Duration of hospital stay of newborn > 7 days	5(23.8%)	3(10.3%)
Early neonatal death (within 7 days of life)	7(33.3%)	2(6.8%)

Regarding admission to newborn nursery, 17(80.9%) out of 21 newborns were admitted in nursery in group A and only 3(10.4%) out of 29 newborns were admitted in nursery in group B. Apgar score was low (≤ 5) in 15 (17.4%) out of 21 newborns in group A and was low in 7(24.1%) of 29 newborn in group B. Five (23.8%) newborns out of 21 in group A remained admitted hospital for more than 7 days and this rate was only

10.3% in group B. Early neonatal death rate was 33.3% in group A i.e. 7 out of 21 newborns died within the first 7 days of life. In group B, 2(6.8%) out of 29 newborns died within the first 7 days of life.

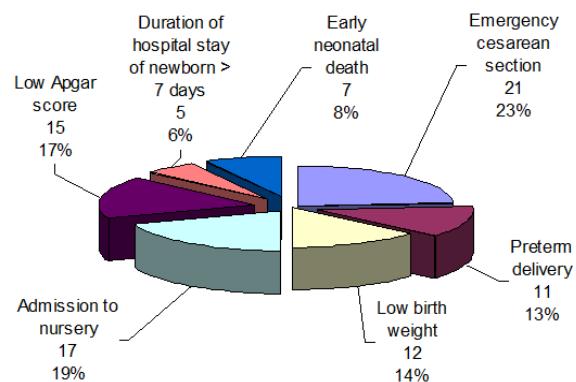


Figure No.2: Percentage Distribution of Complications in Abnormal Doppler Findings (n=21) Total No. of Responses = (88)

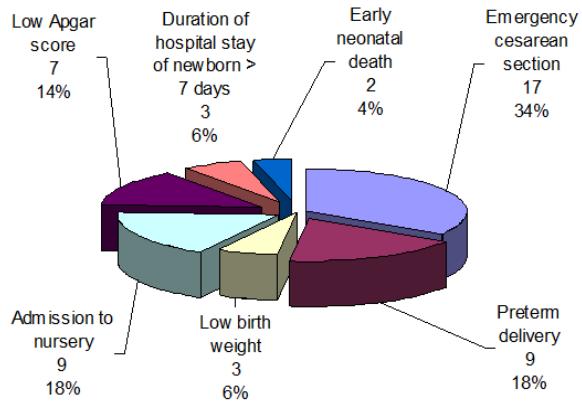


Figure No.3: Percentage Distribution of Complications in Normal Doppler Findings (n=29) Total No. of Responses = (50)

DISCUSSION

The doppler study allows a non invasive assessment of uteroplacental insufficiency and is an accurate method for diagnosis and management of fetal growth retardation. The present study highlights the importance of doppler flow study in umbilical artery for the diagnosis and management of intrauterine growth retardation.

In present study, the umbilical artery doppler flow findings were abnormal in 42% of patients. In a study conducted at Military hospital Rawalpindi in June 2005 by Munawar Jannat Rana and colleagues umbilical artery doppler flow findings were abnormal in 40% of patients⁴. So result of our study coincide well with above mentioned study. Low APGAR score was found in 71.4% of newborns in this study while Munawar

Jannat Rana and colleagues⁵ have also reported very poor APGAR score in their study.

In present study, 23.8% of newborns remained admitted in hospital for more than 7 days while in study by Munawar Jannat Rana et al, 68% of newborns remained admitted in hospital but the stay limit was more than 48 hours⁴. Rate of admission of newborns to neonatal nursery was 80.9% with abnormal doppler findings in this study while in study by Munawar Jannat Rana et al this rate was 75%⁴. Rate of neonatal death in this study was 33.3% of newborns with abnormal doppler findings while this rate was 17.8% in study by Munawar Jannat Rana et al⁴. Perinatal mortality was 9.8% in the study conducted by M. Soregaroli et al⁵ while in our study was perinatal mortality rate was 33.3%. All these studies show that there is an increase in the incidence of low APGAR score, days of admission to NICU and incidence of perinatal mortality in newborns having abnormal umbilical artery doppler.

The study conducted by Seyam YS and colleagues consisted of women with abnormal doppler velocimetry. The fetuses with abnormal doppler velocimetry had a significantly higher incidence of low birth weight, admission to neonatal intensive care unit and immediate cesarean section⁶. So this study also concluded that fetuses with abnormal doppler velocimetry are at higher risk of intrauterine growth retardation than the fetuses with normal doppler waveforms.

The study conducted by Borrelli AL et al confirms the validity of doppler ultrasonography in the management and in the choice of timing for birth in cases of fetal growth restriction⁷.

Umbilical artery doppler measurements may help the clinician to decide whether a small fetus is truly growth restricted. Baschat and Weiner looked at UA resistance to determine if it can help to improve the accuracy of diagnosing IUGR and to identify a small fetus at risk of chronic hypoxemia. These investigators identified 308 babies greater than 23 weeks' at the time of delivery who had an AC of less than the 2.5 percentile, an EFW of less than the 10th percentile or both criteria. UA measurements were obtained on all of these fetuses. The positive predictive values of AC alone and EFW alone for the diagnosis of IUGR were 36.6% and 50%, respectively. An elevated UA systolic-to-diastolic ratio yielded a positive predictive value of 53.3% for postnatally confirmed IUGR. Among all 138 identified fetuses with an elevated UA systolic-to-diastolic ratio, a 10-fold increase occurred in the rate of admission to and the duration of stay in neonatal ICUs and in the frequency and severity of respiratory distress syndrome. Equally importantly, no fetus with normal doppler measurements was delivered with documented metabolic acidemia⁸.

CONCLUSION

This study underlines the existence of a strict correlation between umbilical doppler velocimetry and an increased incidence of perinatal complications in intrauterine growth retarded fetuses.

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