

Study on Doppler Findings and Neonatal Outcome in Fetal Growth Restriction: A Teaching Hospital Based Study

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Abstract

Background: Intrauterine growth restriction (IUGR) is defined as sonographic estimated fetal weight <10th percentile for gestational age. Intrauterine growth retardation (IUGR) is associated with an increased risk of perinatal mortality, morbidity, and impaired neurodevelopment. **Subjects and Methods:** A total of 65 women with singleton pregnancies of 28 weeks and above, who were diagnosed with fetal growth restriction and were evaluated by Doppler studies according to inclusion and exclusion criteria. **Results:** On analysing the antenatal Doppler studies, abnormal CP ratio, elevated umbilical artery PI and reduced MCA PI were found in 12, 16 and 32 fetuses respectively. CP ratio showed a sensitivity of 19.61 % and specificity of 85.71 % with a positive predictive value of 83.33 % and negative predictive value of 22.64 %. Pulsatility index of umbilical artery showed sensitivity of 23.53 % and specificity of 71.43 %, with Positive predictive value of 75.00 % and Negative predictive value of 20.41 %. Pulsatility index of MCA showed a sensitivity of 52.94 % and specificity of 64.29 % with PPV of 84.38 % and NPV of 27.27 %. **Conclusion:** The IUGR is an important cause of perinatal morbidity and mortality. Antenatal Doppler analysis of UA and MCA can predict neonatal outcome in FGR fetuses. The fetal growth restriction has considerable perinatal and long term effects on the neonate. Once it is suspected careful Doppler evaluation can identify fetuses at risk for poor neonatal outcome.

Keywords: Doppler Finding Tests, Neonatal and FGR.

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Received: November 2018

Accepted: December 2018

Introduction

Intrauterine growth restriction (IUGR) is defined as sonographic estimated fetal weight <10th percentile for gestational age.^[1] According to the American College of Obstetricians and Gynecologists, IUGR is “one of the most common and complex problems in modern obstetrics.”^[2] This characterization is understandable considering the various published definitions, poor detection rate, limited preventive or treatment options, multiple associated morbidities, and increased likelihood of perinatal mortality associated with IUGR. Suboptimal growth at birth is linked with impaired intellectual performance and diseases such as hypertension and obesity in adulthood.^[2] Fetal growth restriction (FGR) refers to a fetus that has failed to achieve its genetically determined growth potential and affects up to 5-10% of pregnancies. The World Health Organization defines SGA as a neonatal weight of less than 2500 grams at term. SGA pregnancies often exhibit normal fetal Doppler, while FGR due to placental disease exhibits characteristic maternal and fetal Doppler abnormalities. Doppler studies are non-invasive and help to identify the degree of placental insufficiency and also to detect worsening of the situation, there by decision to intervene can be taken once the need arises. It has been reported that elevated S/D ratio in the umbilical artery can lead to poorer neonatal outcomes even in the absence of

FGR.^[3] Increased adverse reactions in short term and long term development has been observed in FGR fetuses when compared with SGA fetuses.^[4,5] Hence it can be said that Doppler studies provide a valuable insight into the intra-uterine environment. The vessels that are evaluated in obstetric Doppler assessment to monitor FGR are uterine artery, umbilical artery, middle cerebral artery and ductus venosus. Most of the studies have shown that umbilical and middle cerebral artery pulsatility index values are better predictors of fetal outcome. Ductus venosus impairment signifies impending fetal compromise like intra-uterine fetal demise and has a high rate of perinatal mortality. The sequential pattern of flow abnormalities in UA, MCA and DV in that order has been observed in several studies and it has been observed that the UA and MCA are better tools for monitoring fetal well-being and to predict fetal-neonatal outcome in upto 88% of the cases.^[6] The cerebro-placental ratio is obtained by dividing MCA PI by UA PI. It is found to be a better predictor of perinatal outcome than MCA PI or UA PI alone.^[7] Aim of this present study was to be the doppler findings tests and neonatal outcome in fetal growth restriction.

Subjects and Methods

This present study was carried out in the Department of

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Radiology, Nimra Institute of Medical Sciences in collaboration with the Department of Obstetrics and Gynecology during the period from July 2017 to October 2018. A total of 65 women with singleton pregnancies of 28 weeks and above, who were diagnosed with fetal growth restriction and were evaluated by Doppler studies according to inclusion and exclusion criteria. These women and their respective neonates were followed up until discharge from hospital. Once FGR was diagnosed in the antenatal period, the women underwent Doppler studies of maternal uterine artery and fetal umbilical and middle cerebral arteries. Repeat ultrasonography and Doppler were done as necessary and antenatal steroid administration was given to women under 34 weeks' gestational age. The antenatal Doppler evaluation results were compared with neonatal outcome like NICU admissions, length of NICU stay, and need of ventilator, CPAP and complications to the neonates. The predictive value of Doppler evaluation and NICU admission was analysed. Also, antenatal Doppler findings and neonatal outcomes were compared according to gestational age at delivery. The length of NICU stay was used to assess the neonatal morbidity. NICU stay of <5 days, 6-10 days and >10 days corresponded to mild, moderate and severe neonatal morbidity respectively. The influence of gestational age on the length of NICU stay was studied. These data collected from the study will be analyzed using sensitivities, specificity and predictive value.

Results

Table 1: Demographic characteristics of Maternal and neonatal

Parameters	No. Of Cases (%)	
Age	<20	7(10.8)
	20-30	58
Co-morbidities	HTN	33(50.8)
	GDM	0(0.0)
Mode of Delivery	Vaginal	9(13.8)
	LSCS	56(86.15)
Gestational age at delivery	>37 week	36(55.4)
	34-37 week	18(27.7)
	<34 week	11(16.9)
Birth weight	1.5-2.5kg	61(93.8)
	<1.5kg	4(6.15)
NICU admissions	>37 week	22(43.13)
	34-37 week	20(39.2)
	<34 week	09(17.6)
NICU management	Ventilator	1(1.96)
	CPAP	8(15.7)
	Oxygen support	42(82.3)

Table 2: Doppler in predicting NICU

Doppler variables		Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
CP ratio	10(TP) 02(FP)	19.61	85.71	83.33	22.64	33.85
	41(FN) 12(TN)					
PI umbilical A	12(TP) 04(FP)	23.53	71.43	75.00	20.41	33.85
	39(FN) 10(TN)					
PI MCA	27(TP) 05(FP)	52.94	64.29	84.38	27.27	55.38
	24(FN) 09(TN)					

Fetal growth restriction (FGR) contributes not only neonatal

This present study was carried out on 65 women with singleton pregnancies of 28 weeks and above, who were diagnosed with fetal growth restriction and were evaluated by Doppler studies according to inclusion and exclusion criteria. Out of these, 36 patients (55.4%) delivered at term, 18 patients delivered between 34-37 weeks of gestation and 11 patients delivered before 34 weeks. On analysing the antenatal Doppler studies, abnormal CP ratio, elevated umbilical artery PI and reduced MCA PI were found in 12, 16 and 32 fetuses respectively [Figure 2].

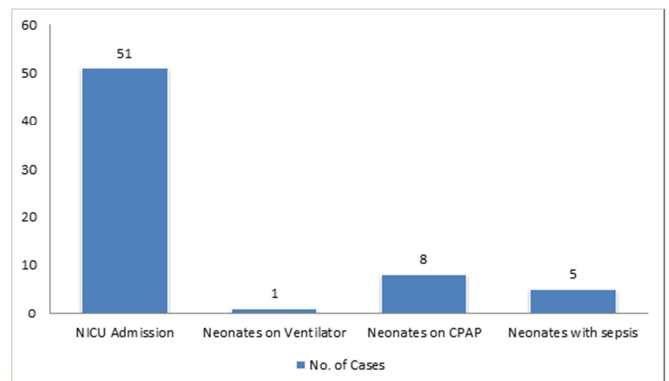


Figure 1: Neonatal outcomes

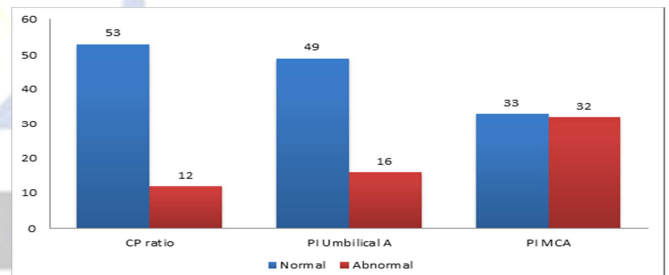


Figure 2: Doppler variables studied.

In [Table 2], the CP ratio showed a sensitivity of 19.61 % and specificity of 85.71 % with a positive predictive value of 83.33 % and negative predictive value of 22.64 %. Pulsatility index of umbilical artery showed sensitivity of 23.53 % and specificity of 71.43 %, with Positive predictive value of 75.00 % and Negative predictive value of 20.41 %. Pulsatility index of MCA showed a sensitivity of 52.94 % and specificity of 64.29 % with PPV of 84.38 % and NPV of 27.27 %.

morbidity and mortality but also to major psychiatric

sequelae as depression and suicide. Fetal growth restriction affects 5-10% of pregnancies.^[8] Fetal growth restriction is a common condition seen during antenatal surveillance, with significant perinatal complications. Apart from fetal biometry, Doppler evaluation of uterine artery, umbilical artery, middle cerebral artery and ductus venosus are important antenatal surveillance tools and prognosticators as seen in several studies. Umbilical artery identifies increased placental resistance by an increased PI value. Absent or reversed flow in the umbilical artery appears after >50% of placental vessels are obliterated.^[6] Studies have shown that monitoring of FGR fetuses by umbilical artery Doppler improves neonatal outcomes.^[9] The middle cerebral artery normally has a high resistance flow. A low PI of MCA indicates brain sparing effect. However, at a later stage of FGR, false normalization of MCA PI may indicate failing fetal circulation. Cerebral placental ratio (CP ratio) is obtained by dividing MCA PI by UA PI. A value <1 is abnormal. Studies have shown that it is a better predictor of adverse perinatal outcome compared to MCA PI or UA PI alone.^[10] In the current study, sensitivity in predicting NICU admission for UA PI was 23.53%, MCA PI was 52.94% and CP ratio was 19.61%. The specificity in predicting NICU admission for UA was 71.43%, MCA was 64.29% and CP ratio was 85.71%. In a study by Dhand H et al, the predictive value for Doppler for detecting abnormal fetal outcome, the sensitivity for UA PI and MCA PI was 44%, 71% respectively and specificity was 61.5% and 92% respectively.^[11] In another study by Mishra D et al, the predictive value of Doppler in perinatal outcome showed the sensitivity of UA PI, MCA PI and CP ratio to be 53%, 43% and 86% respectively and the specificity to be 82%, 80% and 92%.^[12] In the present study, the positive predictive value for UA PI, MCA PI and CP ratio was 75, 84.38 and 83.33 respectively. The negative predictive value for the same was 20.41, 27.27 and 22.64 respectively. In the study by Dhand H et al mentioned above, the PPV for predicting fetal outcome for UA PI and MCA PI was 83% and 94% and NPV was 20% and 65% respectively. Current challenges in the clinical management of IUGR include accurate diagnosis of the truly growth-restricted fetus, selection of appropriate fetal surveillance, and optimizing the timing of delivery.^[13-15]

Conclusion

These findings suggest that the IUGR is an important cause of perinatal morbidity and mortality. Antenatal Doppler analysis of UA and MCA can predict neonatal outcome in FGR fetuses. The fetal growth restriction has considerable perinatal and long term effects on the neonate. Once it is

suspected careful Doppler evaluation can identify fetuses at risk for poor neonatal outcome. Significant advances have been made in the understanding of the complex etiology and pathophysiology of FGR. This knowledge will certainly aid the clinician to optimize antepartum monitoring and time delivery of FGR infants.

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How to cite this article: Neelapu KK. Study on Doppler Findings and Neonatal Outcome in Fetal Growth Restriction: A Teaching Hospital Based Study. *Asian J. Med. Radiol. Res*. 2018;6(2):20-22.
DOI: dx.doi.org/10.21276/ajmrr.2018.6.2.6

Source of Support: Nil, **Conflict of Interest:** None declared.