Original Article

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Evaluation of Findings and Neonatal Outcome in Fetal Growth Restriction: A Comparative Study

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Abstract

Background: Fetal growth restriction (FGR) is a condition in which a foetus fails to reach its genetically determined growth potential. It affects 5-10% of pregnancies. **Subjects and Methods:** A total of 74 women with singleton pregnancies of 28 weeks or more were examined using Doppler examinations based on inclusion and exclusion criteria. **Results:** Out of the 74 neonates, 67 (90.5%) had a birth weight of 1.5-2.5 kg, 05 (6.8%) weighed more than 2.5 kg, and 2 (2.7%) weighed less than 1.5 kg. Fifty-seven newborns needed to be admitted to the NICU, with 27 (47.4%) born as term neonates and 30 (52.6%) born as pre-term neonates. In the NICU, 2 (3.6%) neonates needed ventilator assistance, 11 (20.0%) neonates needed CPAP, and the rest needed oxygen support. Sepsis was treated in 4 (5.4%) of the newborns. **Conclusion:** The newborn suffers significant perinatal and long-term consequences as a result of foetal growth restriction.

Keywords: Neonatal and FGR Doppler Finding Tests.

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Introduction

Failure to attain particular foetal biometric parameters or estimated weight (below than 10th percentile) by a specific gestational age is referred to as foetal growth restriction (FGR). Different forms of pre- and post-natal morbidity and mortality are caused by FGR. The prevalence of FGR is estimated to be between 3 and 10%.[1,2] Sonographic estimated foetal weight 10th percentile for gestational age is classified as intrauterine growth restriction (IUGR).[3] IUGR is "one of the most common and difficult disorders in modern obstetrics," according to the American College of Obstetricians and Gynecologists. Given the different published criteria, low detection rate, limited preventive or treatment options, several related morbidities, and increased risk of perinatal mortality linked with IUGR, this classification is comprehensible. In maturity, suboptimal development is connected to reduced intellectual performance and disorders like hypertension and obesity.[4] Fetal growth restriction (FGR) is a condition in which a foetus fails to reach its genetically determined growth potential. It affects 5-10% of pregnancies. SGA is defined as a newborn weight of less than 2500 grammes at term, according to the World Health Organization. SGA pregnancies frequently have normal foetal Doppler, whereas FGR caused by placental illness has distinct maternal and foetal Doppler abnormalities. Doppler studies are non-invasive and aid in determining the degree of placental insufficiency as well as detecting worsening of the situation, allowing for the decision to intervene if necessary. Even in the absence of FGR, a high S/D ratio in the umbilical artery has been linked to poor newborn outcomes.[5] When comparing FGR foetuses to SGA foetuses, more unfavourable effects have been seen in both short and long term development. As a result, Doppler studies can be said to provide useful insight into the intrauterine environment. The uterine artery, umbilical artery, middle cerebral artery, and ductus venosus are all assessed during an obstetric Doppler assessment to monitor FGR. The pulsatility index values of the umbilical and middle cerebral arteries have been found to be better indicators of foetal outcome in the majority of investigations.[6,7] Impairment of the ductus venosus signals impending foetal compromise, such as intrauterine foetal death, and has a high rate of perinatal mortality. Several studies have discovered a sequential pattern of flow anomalies in the UA, MCA, and DV in that sequence, and it has been discovered that the UA and MCA are better tools for monitoring foetal well-being and predicting fetal-neonatal outcome in up to 88 percent of instances.[8] Calculate the cerebro-placental ratio by dividing MCA PI by UA PI. It

has been discovered that it is a stronger predictor of perinatal outcome than MCA PI or UA PI alone.[9] The purpose of this study was to investigate the relationship between doppler results tests and newborn outcome in prenatal growth restriction.

Subjects and Methods

The current research was conducted in the Department of Radiology, World College of Medical Sciences Research and Hospital, Jhajjar, Haryana, in partnership with the Department of Obstetrics and Gynecology, between October, 2018 and September, 2019. A total of 74 women with singleton pregnancies of 28 weeks or more were examined using Doppler examinations based on inclusion and exclusion criteria. These ladies and their newborns were monitored until they were discharged from the hospital. The results of the antenatal Doppler evaluation were compared to newborn outcomes such as NICU admissions, length of NICU stay, requirement for ventilator, CPAP, and neonatal problems. The correlation between Doppler examination and NICU admission was investigated. In addition, prenatal Doppler results and neonatal outcomes were compared by gestational age at birth. The amount of time spent in the NICU was utilised to determine neonatal morbidity. Mild, moderate, and severe newborn morbidity were associated with NICU stays of 5 days, 6-10 days, and >10 days, respectively. The effect of gestational age on NICU stay length was investigated. Sensitivity, specificity, and predictive value will be used to examine the data acquired during the investigation.

Results

The study included a total of 74 patients, and [Figure 1] depicts the patient distribution by age group. In [Figure 2], 43 patients (58.1%) delivered at term, 24 patients (32.4%) delivered between 34 and 37 weeks, and 07 patients (9.5%) delivered before 34 weeks of pregnancy.

Out of the 74 neonates, 67 (90.5%) had a birth weight of 1.5-2.5 kg, 05 (6.8%) weighed more than 2.5 kg, and 2 (2.7%) weighed less than 1.5 kg. Fifty-seven newborns needed to be admitted to the NICU, with 27 (47.4%) born as term neonates and 30 (52.6%) born as pre-term neonates. In the NICU, 2 (3.6%) neonates needed ventilator assistance, 11 (20.0%) neonates needed CPAP, and the rest needed oxygen support. Sepsis was treated in 4 (5.4%) of the newborns [Table 1 and 2].

An aberrant CP ratio, raised umbilical artery PI, and lowered MCA PI were identified in 15 (20.3%), 19 (25.7%), and 36 (48.6%) foetuses, respectively, in antenatal Doppler tests [Table 3]. The ability of the CP ratio, the PI of the umbilical artery, and the PI of the MCA to predict neonatal NICU

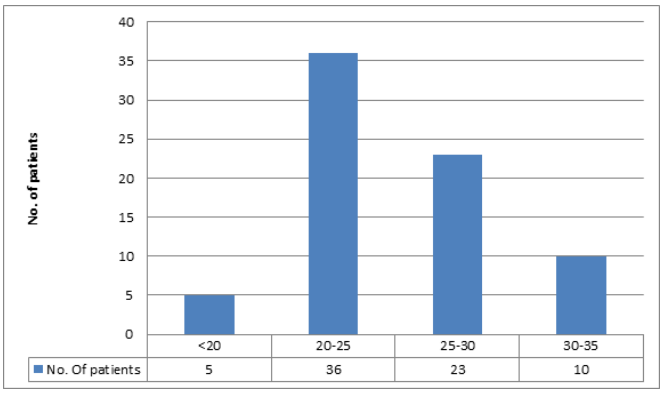

Figure 1: Shows the distribution of patients a/c to age group.

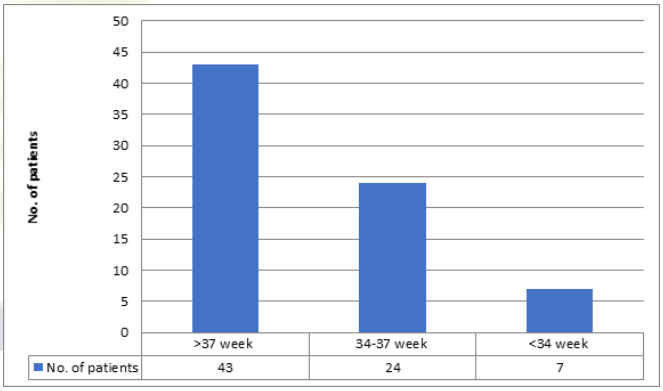

Figure 2: Shows the distribution of patients a/c to gestational age at delivery.

admission was studied statistically. With a positive predictive value of 81.8 percent and a negative predictive value of 20.6 percent, the CP ratio had a sensitivity of 15.3 percent and specificity of 86.7 percent. The value of 'p' was 0.52. The umbilical artery pulsatility index had a sensitivity of 16.9% and a specificity of 80.0 percent, with a PPV of 76.9% and an NPV of 19.6 percent. The value of 'p' was 0.64. The MCA pulsatility index had a sensitivity of 50.8 percent and a specificity of 67.7%, with a PPV of 85.7 percent and an NPV of 25.6 percent. The value of 'p' was 0.36. [Table 4]. A statistical analysis utilising the Fisher Exact test to determine the effect of gestational age on NICU stay length revealed that neonates born at term had shorter NICU stays, resulting in lower morbidity. For this test, the 'p' value was 0.04. [Table 5].

Table 1: Demographic characteristics of Maternal and neonatal.

Parameters		No. Of patients (%)
Co-morbidities	HTN	38(51.4%)
	GDM	00(0.0%)
Mode of Delivary	Vaginal	26(35.1%)
	LSCS	48(64.9%)
Birth weight	>2.5 kg	05 (6.8%)
	1.5-2.5kg	67(90.5%)
	<1.5kg	2(2.7%)
NICU admissions	>37 week	27(47.4%)
	34-37 week	21(36.8%)
	<34 week	9(15.8%)
NICU management	Ventilator	2(3.6%)
	CPAP	11(20.0%)
	Oxygen support	44(77.2%)

Table 2: Neonatal outcomes.

Outcome	No. of patients (%)
NICU admission	57 (77.1%)
Neonates on ventilator	2(3.6%)
Neonates on CPAP	11(20.0%)
Neonates with sepsis	4 (5.4%)

Table 3: Doppler variables studied.

Variables		No. of patients (%)
CP ratio	Normal	59 (79.7%)
	Abnormal	15 (20.3%)
PI umbilical A	Normal	55 (74.3%)
	Abnormal	19 (25.7%)
PI MCA	Normal	38 (51.4%)
	Abnormal	36 (48.6%)

Table 4: Doppler in predicting NICU.

Doppler variables			Sensitivity	Specificity	Positive predictive value	Negative predictive value	Accuracy
CP ratio	9 (TP)	02 (FP)	15.3	86.7	81.8	20.6	34.6
	50 (FN)	13 (TN)					
PI	10 (TP)	03 (FP)	16.9	80.0	76.9	19.6	34.4
	49 (FN)	12 (TN)					
PI MCA	30 (TP)	05 (FP)	50.8	67.7	85.7	25.6	56.02
	29 (FN)	10 (TN)					

Table 5: Gestational age at birth and neonatal morbidity.

Gestational age at	Total	NICU Stay in days		
		<5 days	6-10 days	>10 days
>37 week	26 (45.6%)	16 (59.3%)	8 (42.1%)	2 (18.2%)
34-37 week	24 (42.1%)	11 (40.7%)	6 (31.6%)	7 (63.6%)
<34 week	07 (12.3%)	00 (00.0%)	5 (26.3%)	2 (18.2%)
Total NICU admissions	57 (100.0%)	27 (100.0%)	19 (100.0%)	11 (100.0%)

Discussion

Fetal growth restriction is a common prenatal surveillance finding that can lead to serious postnatal problems. Apart from foetal biometry, Doppler examination of the uterine artery, umbilical artery, middle cerebral artery, and ductus venosus has been shown in multiple studies to be useful antenatal surveillance techniques and prognosticators. An elevated PI value in the umbilical artery indicates higher placental resistance. After >50% of the placental arteries have been obliterated, the umbilical artery has no or reversed flow. Studies have demonstrated that umbilical artery Doppler monitoring of FGR pregnancies improves newborn outcomes.[10] In most cases, the middle cerebral artery has a high resistance flow. MCA with a low PI has a brain sparing effect. False normalisation of MCA PI at a later stage of FGR, on the other hand, may suggest poor foetal circulation. MCA PI is divided by UA PI to get the cerebral placental ratio (CP ratio). A value of 1 is considered abnormal. When compared to MCA PI or UA PI alone, studies have demonstrated that it is a greater predictor of unfavourable perinatal outcome.[11] The purpose of this study was to see if a Doppler study in FGR pregnancies could predict newborn outcomes such as NICU admission and length of stay. In the current study, the UA PI had a sensitivity of 16.9% in predicting NICU admission, whereas the MCA PI had a sensitivity of 50.8 percent and the CP ratio had a sensitivity of 15.3 percent. UA had a specificity of 80.0 percent in predicting NICU admission, an MCA of 67.7%, and a CP ratio of 86.7 percent in predicting NICU admission. In a research by Dhand H et al, the predictive value of Doppler for diagnosing adverse foetal outcome was 44 percent for UA PI and 71 percent for MCA PI, respectively, and 61.5 percent and 92 percent for specificity.[12] According to another study by Mishra D et al, the sensitivity of the UA PI, MCA PI, and CP ratio in predicting perinatal outcome was 53 percent, 43 percent, and 86 percent, respectively, while the specificity was 82 percent, 80 percent, and 92 percent.[13] The positive predictive values for UA PI, MCA PI, and CP ratio were 76.9, 85.7, and 81.8, respectively, in this investigation. The corresponding negative predictive values were 19.6, 25.6, and 20.6. The PPV for predicting foetal fate for UA PI and MCA PI was 83 percent and 94 percent, respectively, in the study by Dhand H et al noted above, and the NPV was 20 percent and 65 percent. The gestational age at delivery and NICU stay were examined in this study, and it was discovered that neonates born at term had shorter NICU stays than neonates born very preterm (p value 0.04). In contrast, Baschat AA et al. discovered that gestational age at delivery was a substantial driver of neonatal outcome, even when antenatal Doppler indices indicated outcomes such as foetal distress and stillbirth.[14] Accurate diagnosis of the genuinely growth-restricted foetus, selection of adequate foetal surveillance, and delivery time optimization are all current issues in the clinical management of IUGR.[15,16]

Conclusion

The newborn suffers significant perinatal and long-term consequences as a result of foetal growth restriction. Once detected/suspected, a detailed Doppler scan can identify foetuses at risk for NICU admission and morbidity, allowing for antenatal risk calculation and prognostication. Based on the Doppler findings, in-utero transfer to tertiary care centres can be explored, providing for superior post-natal management and outcomes. Neonatal outcomes are better for those born at or near term than for those born very preterm, indicating that gestational age is a significant factor of neonatal outcome.

References

1. Muresan D, Rotar IC, Stamatian F. The usefulness of fetal Doppler evaluation in early versus late onset intrauterine growth restriction. Review of the literature. Med Ultrason. 2016;18(1):103–109. Available from: https://doi.org/10.11152/mu.2013.2066.181.dop.
2. Rasyid H, Bakri S. Intra-uterine Growth Retardation and Development of Hypertension. Acta Med Indones. 2016;48(4):320–324.
3. Battaglia FC, Lubchenko LO. A practical classification of newborn infants by weight and gestational age. J Pediatr. 1967;71(2):159–163. Available from: https://doi.org/10.1016/s0022-3476(67)80066-0.
4. Buttar HS, Li T, Ravi N. Prevention of cardiovascular diseases: Role of exercise, dietary interventions, obesity and smoking cessation. Exp Clin Cardiol. 2005;10(4):229–249.

5. Filmar G, Panagopoulos G, Minior V, Barnhard Y, Divon MY. Elevated umbilical artery systolic/diastolic ratio in the absence of fetal growth restriction. Arch Gynecol Obstet. 2013;288(2):279–285. Available from: https://doi.org/10.1007/s00404-013-2764-5.
6. Beckerath V, Kollmann AK, Rotky-Fast M, Karpf C, Lang E, Klaritsch U, et al. Perinatal complications and long term neurodevelopmental outcome of infants with intrauterine growth restriction. Am J Obstet Gynecol. 2013;208(2):130. Available from: https://doi.org/10.1016/j.ajog.2012.11.014.
7. Roy A, Mukherjee S, Bhattacharyya SK, Banerjee P, Das B, Patra KK. Perintal outcome in pregnancies with intra-uterine growth restriction by using umbilical and middle cerebral artery colour Doppler. Indian Med Assoc. 2012;110(3):154–157.
8. Unterscheider J, Daly S, Geary MP, Kennelly MM, Auliffe FMM, O'Donoghue K, et al. Predictable progressive Doppler deterioration in IUGR: does it really exist? Am J Obstet Gynecol. 2013;209(6):539. Available from: https://doi.org/10.1016/j.ajog.2013.08.039.
9. Bano S, Chaudhary V, Pande S, Mehta VL, Sharma AK. Color doppler evaluation of cerebral-umbilical pulsatility ratio and its usefulness in the diagnosis of intrauterine growth retardation and prediction of adverse perinatal outcome. Indian J Radiol Imag. 2010;20(1):20–25. Available from: https://doi.org/10.4103/0971-3026.59747.
10. Figueras F, Gardosi J. Intrauterine growth restriction: new concepts in antenatal surveillance, diagnosis and management. Review Article. Am J Obstet Gynecol. 2011;204(4):288–300. Available from: https://doi.org/10.1016/j.ajog.2010.08.055.
11. Gupta BD, Sharma R, Shah K. Prediction of IUGR and adverse perinatal outcome by colour Doppler examination of UA PI and MCA:UA PI Ratio. Int J Contemp Med Res. 2016;3(4):976–984.
12. Dhand H, Kansal K, A D. Middle cerebral artery doppler indices better predictor for fetal outcome in IUGR. J Obstet Gynecol India. 2011;61(2):166–171. Available from: https://dx.doi.org/10.1007/s13224-011-0018-7.
13. Mishra D, Sakhi P, Saraf A, Gupta A, Soni K, Dhruw S. Role of obstetric Doppler in prediction of adverse perinatal outcome in intrauterine growth retardation and pregnancy induced hypertension. Sch J App Med Sci. 2013;1(6):1016–1020.
14. Baschat AA, Gembruch U, Reiss I, Gortner L, Weiner CP, Harman CR. Relationship between arterial and venous Doppler and perinatal outcome in fetal growth restriction. Ultrasound Obstet Gynecol. 2000;16(5):407–413. Available from: https://doi.org/10.1046/j.1469-0705.2000.00284.x.
15. Baschat AA. Arterial and venous Doppler in the diagnosis and management of early onset fetal growth restriction. Early Hum Dev. 2005;81(11):877–887. Available from: https://doi.org/10.1016/j.earlhumdev.2005.09.008.
16. Baschat AA, Gembruch U, Reiss I, Gortner L, Weiner CP, Harman CR. Relationship between arterial and venous Doppler and perinatal outcome in fetal growth restriction. Ultrasound Obstet Gynecol. 2000;16(5):407–413. Available from: https://doi.org/10.1046/j.1469-0705.2000.00284.x.

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