Section: Radiodiagnosis

Research

CLINICAL STUDY ON THE DOPPLER FINDINGS AND NEONATAL OUTCOME IN FETAL GROWTH RESTRICTION IN TERTIARY CARE TEACHING HOSPITAL: A COMPARATIVE STUDY

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Abstract

Background: Up to 5–10% of pregnancies may be affected by foetal growth restriction (FGR). Increased prenatal mortality and morbidity are linked to it. Doppler studies help to prognosticate outcomes, identify at-risk foetuses, and time interventions. Here, it is investigated whether Doppler investigations can forecast neonatal outcomes. The aim is to purpose of the current study is to evaluate Doppler tests' capacity to forecast neonatal outcomes in FGR foetuses. **Materials and Methods:** A prospective research was conducted on 72 women who were carrying singletons at gestational ages greater than 28 weeks and were found to have FGR. The patients underwent Doppler evaluation. A comparison was made between abnormal Doppler indices and neonatal outcomes such perinatal mortality, NICU admission, ventilator or CPAP support, sepsis, and phototherapy. **Result:** The ability of the CP ratio, PI of the umbilical artery, and PI of the MCA to forecast neonatal NICU admission was statistically analysed. The sensitivity and specificity of the CP ratio were 18.4% and 76.2%, respectively, with a positive predictive value of 72.6% and a negative predictive value of 19.2%. The value of "p" was 0.42. The umbilical artery's pulsatility index demonstrated sensitivity of 26.2%, specificity of 76.4%, PPV of 78.4%, and NPV of 21.4%. p = 0.52 was the value. The sensitivity and specificity of the MCA pulsatility index were 59.4% and 64.6%, respectively, with a PPV of 86.2% and NPV of 26.4%. The value of "p" was 0.24. According to statistical analysis that used the Fisher Exact test to determine the effect of gestational age on the length of NICU stay, neonates who were born at term had shorter NICU stays, which translated to lower morbidity. The 'p' value for this test was 0.04.**Conclusion:** In FGR foetuses, antenatal Doppler measurement of UA and MCA can forecast neonatal prognosis. The sensitivity, specificity, positive predictive value, and negative predictive value of this study are comparable to other studies even though the 'p' value was not significant. The result for the newborn is greatly influenced by gestational age at birth.

INTRODUCTION

Up to 5–10% of pregnancies may result in foetal growth restriction (FGR), which refers to a foetus that has not developed to its genetically set potential. Fetal mortality in utero, foetal morbidity during childbirth, and surgical deliveries are all common. Iatrogenic prematurity is a relevant concern in preterm FGR, which takes place before 34 weeks of gestation. Respiratory problems, polycythemia, hypoglycemia, intraventricular haemorrhage, and hypothermia are among symptoms of FGR in neonates. Long-term effects include cerebral palsy, developmental delays, behavioural problems, and adult metabolic

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syndrome. Fetuses that are small for gestational age must be distinguished from those that are FGR (SGA). SGA is characterised by a newborn weight of less than 2500 grammes at term, according to the World Health Organization. Fetal Doppler is frequently normal during SGA pregnancies, whereas FGR caused by placental illness shows distinctive maternal and foetal doppler abnormalities. Doppler scans are non-invasive and assist in determining the level of placental insufficiency as well as spotting when things are getting worse, allowing for the decision to intervene when it is necessary. Even in the absence of FGR, increased S/D ratio in the umbilical artery has been linked to worse newborn outcomes.[1,2] When compared to SGA foetuses, more negative effects have been seen in short- and long-term development in FGR foetuses.[3] So it is safe to say that Doppler investigations offer a useful window into the uterine environment. The uterine artery, umbilical artery, middle cerebral artery, and ductus venosus are the vessels that are assessed during an obstetric Doppler examination to monitor FGR. The majority of studies have demonstrated that middle cerebral artery and umbilical artery pulsatility index (PI) values are more accurate indicators of neonatal outcome. A high rate of perinatal mortality and ductus venosus impairment indicate impending foetal compromise, such as intrauterine foetal death. Numerous studies have noted the sequential pattern of flow abnormalities in the umbilical artery (UA), middle cerebral artery (MCA), and ductus venosus (DV), in that order, and it has been found that the UA and MCA are better tools for monitoring foetal health and to predict fetal-neonatal outcome in up to 88% of cases.[4] Calculating the cerebro-placental ratio involves dividing the MCA PI by the UA PI. It is discovered to be a superior perinatal outcome predictor than MCA PI or UA PI alone.[5] The purpose of the current study is to evaluate Doppler tests' capacity to forecast neonatal outcomes in FGR foetuses.

MATERIALS AND METHODS

Women with singleton pregnancies of 28 weeks or longer who were diagnosed with foetal growth restriction and were assessed by Doppler investigations at Kalinga Institute of Medical Sciences, Bhubaneshwar, were included in this prospective study, which was conducted from April 2020 to November 2021. We monitored these ladies and their respective newborns until they were released from the hospital.

Inclusion & Exclusion Standards

Singleton pregnancy, Gestational age of at least 28 weeks, Ultrasonography-detected foetal growth limitation, and additional analysis using Doppler investigations. Delivery and newborn care are provided at the same facility, the Kalinga Institute of Medical Sciences in Bhubaneshwar. In exclusion standards, Gestations lasting longer than 28 weeks, and multiple pregnancies chromosomal, congenital, or other abnormalities that limit foetal growth.

The women performed Doppler examinations of the maternal uterine artery, foetal umbilical artery, and foetal middle cerebral artery once FGR was identified during the prenatal period. Women under 34 weeks gestation received prenatal steroid injection and repeat ultrasonography and Doppler as required. Other prenatal conditions like gestational diabetes and hypertension were assessed for, documented, and treated if found. The pregnancy was carried to term and spontaneous labour was anticipated to the extent that the patient's co-morbid conditions and the severity of her FGR permitted. Patients who had significant FGR and abnormal Doppler abnormalities and were unable to carry their pregnancies to term gave birth to premature infants. The study of the newborn outcome looked at factors including birth weight, NICU admission, NICU treatment, NICU stay length, and problems like sepsis, hyperbilirubinemia, neonatal death, etc. The results of the prenatal Doppler evaluation were compared to neonatal outcomes such as NICU admissions, length of stay in the NICU, and requirement for a ventilator, CPAP, and problems for the newborns. Analysis was done on the relationship between Doppler testing and NICU admission. Additionally, prenatal Doppler results and neonatal outcomes were contrasted according to delivery gestational age. Neonatal morbidity was evaluated using the length of NICU hospitalisation. Mild, moderate, and severe newborn morbidity were associated with NICU stays of less than five days, six to ten days, and more than ten days, respectively. It was investigated how gestational age affected the time spent in the NICU. Fisher / Chi-square In a non-parametric framework for the analysis of qualitative data, the exact test has been used to determine the significance of research parameters on a categorical scale between two or more groups. To determine the Doppler findings' ability to predict NICU admission, the following metrics are computed: sensitivity, specificity, PPV, NPV, and accuracy. The data analysis was done using the statistical programme SPSS 20.0.

RESULTS

The study consisted of 76 patients in total. Of these, 21 (27.6%) patients delivered between 34 and 37 weeks of gestation and 13 (17.1%) patients delivered before 34 weeks, for a total of 42 patients (55.3%) who delivered at term.

[Table 1 and 2] shows the seven of the 76 newborns weighed less than 1.5 kg, while 69 of them had birth weights between 1.5 and 2.5 kg. There were 58 newborns who needed NICU hospitalisation, of whom 25 (43.1%) were term neonates and 33 (56.9%) were pre-term. Two (3.4%) newborns in the NICU needed ventilator assistance, ten (17.2%)

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needed CPAP, and the remaining neonates needed oxygen support. Seven (9.2%) newborns received sepsis treatment.

Table 1: Neonatal and maternal parameters.

Variable		No. of patients (%)
Age in years	<20	09 (11.8%)
	20-30	67 (88.2%)
Co-morbidities	HTN	40 (52.6%)
	GDM	0.0
Mode of delivery	Vaginal	11 (14.5%)
	LSCS	65 (85.5%)
Gestational age at delivery	>37 week	42 (55.3%)
	34-37 week	21 (27.6%)
	<34 week	13 (17.1%)
Birth weight	1.5-2.5 kg	69 (90.8%)
	<1.5kg	07 (9.2%)
NICU admissions	>37 week	24 (41.4%)
	34-37 week	23 (39.7%)
	<34 week	11(19.0%)
NICU management	Ventilator	2 (3.4%)
	CPAP	10 (17.2%)
	Oxygen support	43 (74.1%)

Table 2: Neonatal outcomes.

Outcome	No. of patients (%)
NICU admission	58(76.3%)
Neonates on ventilator	2 (3.4%)
Neonates on CPAP	10 (17.2%)
Neonates with sepsis	7 (9.2%)

When antenatal Doppler tests were analysed, it was observed that 15, 19, and 38 foetuses, respectively, had aberrant CP ratios, raised umbilical artery PIs, and lowered MCA PIs.

Table 3: Doppler variables studied

Variables		No. of patients (%)
CP ratio	Normal	61 (80.3%)
	Abnormal	15 (19.7%)
PI umbilical A	Normal	57 (75.0%)
	Abnormal	19 25.0(%)
PI MCA	Normal	38 (50.0%)
	Abnormal	38 (50.0%)

The ability of the CP ratio, PI of the umbilical artery, and PI of the MCA to forecast neonatal NICU admission was statistically analysed. The sensitivity and specificity of the CP ratio were 18.4% and 76.2%, respectively, with a positive predictive value of 72.6% and a negative predictive value of 19.2%. The value of "p" was 0.42. The umbilical artery's pulsatility index demonstrated sensitivity of 26.2%, specificity of 76.4%, PPV of 78.4%, and NPV of 21.4%. p = 0.52 was the value. The sensitivity and specificity of the MCA pulsatility index were 59.4% and 64.6%, respectively, with a PPV of 86.2% and NPV of 26.4%. The value of "p" was 0.24. According to statistical analysis that used the Fisher Exact test to determine the effect of gestational age on the length of NICU stay, neonates who were born at term had shorter NICU stays, which translated to lower morbidity. The 'p' value for this test was 0.04.

DISCUSSION

During antenatal surveillance, foetal growth restriction is a frequent condition that can cause serious postnatal problems. Doppler examination of the uterine artery, umbilical artery, middle cerebral artery, and ductus venosus, in addition to foetal biometry, are significant antenatal surveillance techniques and prognosticators, according to various studies. An elevated PI value in the umbilical artery indicates higher placental resistance. After >50% of the placental arteries are destroyed, there is no flow or flow that is reversed in the umbilical artery. Studies have demonstrated that umbilical artery Doppler monitoring of FGR pregnancies improves newborn outcomes.[6] Normally, the middle cerebral artery has a high flow of resistance. Brain-sparing impact is indicated by a low MCA PI. False normalisation of MCA PI, on the other hand, may signify poor foetal circulation at a later stage of FGR. To calculate the cerebral placental ratio (CP ratio), divide the MCA PI by the UA PI. A value of <1 is unusual. Compared to MCA PI or UA PI alone, studies have demonstrated that it is a greater predictor of a poor perinatal outcome.[7,8] The goal of the current study was to determine whether the Doppler study in FGR pregnancies could accurately predict newborn outcomes, such as admission to the

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NICU and the length of stay there. According to the current study, the sensitivity in predicting NICU admission for UA PI, MCA PI, and CP ratio was 26.2%, 59.4%, and 18.4%, respectively. For UA, MCA, and CP ratio, the specificity in predicting NICU admission was 76.4%, 64.6%, and 76.2%, respectively. In a research by Dhand H et al., the sensitivity for UA PI and MCA PI was 44%, 71%, and specificity was 61.5%, respectively, for diagnosing adverse foetal outcome using Doppler.[9] According to a different study by Mishra D. et al., the predictive value of Doppler in perinatal outcome revealed that the sensitivity of UA PI, MCA PI, and CP ratio were 53%, 43%, and 86%, respectively, and the specificity was 82%, 80%, and 92%.[10] The positive predictive values for the UA PI, MCA PI, and CP ratio in the current investigation were 78.4, 86.2, and 72.6, respectively. The corresponding negative predictive values were 21.4, 26.4, and 19.2, respectively. The PPV for predicting foetal fate for UA PI and MCA PI in the study by Dhand H et al. cited above was 83% and 94%, and the NPV was 20% and 65%, respectively. In the current study, the length of time that neonates spent in the NICU was compared to gestational age at birth, and it was discovered that term newborns spent less time there than very preterm newborns (p value 0.04). In contrast, Baschat AA et alstudy .'s discovered that gestational age at delivery was a significant predictor of neonatal outcome, despite the fact that antenatal Doppler indices might foretell certain outcomes including foetal distress and stillbirth.[11]

CONCLUSION

In conclusion, the newborn experiences significant perinatal and long-term impacts as a result of the prenatal growth limitation. Once it has been identified or suspected, rigorous Doppler screening can spot foetuses at risk for NICU admission and morbidity, allowing for the estimate and prognostication of prenatal risk. Based on the Doppler results, in-utero transfer to tertiary care facilities can be taken into account, improving post-natal management and outcomes. It has been demonstrated that gestational age is a crucial factor in determining the newborn outcome that neonates born at or near term have better outcomes than those born very preterm.

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