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Original article

Middle Cerebral and Umbilical Artery Doppler in Intra Uterine Growth Restriction, Oligohydramnios and Decreased Foetal Movement

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Abstract

Background: Intrauterine growth restriction (IUGR), decreased fetal movement (DFM), and oligohydramnios are conditions that can impact fetal well-being and pregnancy outcomes. Assessing blood flow parameters using Doppler studies, such as UA-PI and MCA-PI, may provide insights into fetal health. **This study aimed to** evaluate the Doppler changes and Doppler indices in the umbilical and middle cerebral arteries and their impact on decision and mode of delivery also pregnancy outcome in cases of intrauterine growth restriction, oligohydramnios and decreased fetal movement. **Methods:** This comparative controlled , interventional, clinical study was conducted on 50 cases (30 IUGR,10 Oligohydramnios,10 Decrease movement) and 50 control subjects. Patients then were subjected to complete history taking, obstetric history, history of the present pregnancy, general examination, abdominal examination to assess the fundal height, maternal weight and height (BMI). Ultrasound, Doppler studies carried out to assess a) Umbilical artery Doppler indices: UA-PI), umbilical artery EDV. b) Middle cerebral artery Doppler indices: MCA-PI, middle cerebral artery EDV. c) Cerebro-umbilical ratio: will be calculated as a ratio of MCA-PI / UA-PI. **Results**: Doppler indices UA-PI, MCA-PI, and C/U ratio demonstrated significant differences among the groups. These indices served as predictors for IUGR, oligohydramnios, and DFM. Neonatal outcomes, such as APGAR scores, birth weight, and NICU admission, exhibited variations among the groups. **Conclusion:** Doppler studies of UA-PI, MCA-PI, and C/U ratio offer valuable insights into the assessment of pregnancies complicated by IUGR, DFM, and oligohydramnios. These indices may serve as predictive tools for identifying fetal compromise and influencing neonatal outcomes.

Keywords: Intrauterine growth restriction; fetal movement; oligohydramnios; Doppler indices.

Introduction

Intrauterine growth restriction (IUGR) remains a prevalent challenge in the field of obstetrics, though its underlying mechanisms are not fully elucidated. Historically, IUGR has been defined as the condition where the estimated fetal weight falls below the 10th percentile for the corresponding gestational age. Its occurrence in pregnancies is estimated to range between 3% and 7% (1). It is important to note that while IUGR is often used interchangeably with small-for-gestational age (SGA), it's imperative to differentiate between the two. SGA refers to newborns with a birth weight below the 10th percentile for their gestational age and sex. However, SGA does not distinguish between genetically small fetuses and those restricted in growth due to pathological factors affecting the mother, placenta, or fetus (2).

One of the earliest indicators of IUGR is the diminished blood flow, particularly during end-diastole, in the umbilical arteries. This results in increased afterload on the right ventricle, leading to a redirection of cardiac output in favor of the left ventricle. Simultaneously, reduced resistance is observed in the cerebral arteries, leading to an augmented blood flow towards the brain at the expense of the lower body (3). Fetal movement (FM) is an essential marker of fetal vitality and central nervous system function. FM is believed to reflect the overall well-being of the fetus and is typically sensed by pregnant women around the 18th to 20th week of gestation, with frequency peaking between 29 and 38 weeks (4).

Oligohydramnios, characterized by an amniotic fluid index (AFI) of 5 cm or less, holds substantial clinical implications. It is considered a risk factor for adverse fetal outcomes and may indicate underlying maternal and/or fetal comorbidities. The identification of oligohydramnios typically necessitates close fetal monitoring. Isolated oligohydramnios (IO) refers to the absence of fetal structural and chromosomal abnormalities, growth restriction, intrauterine infection, or maternal disease (5). Incidence rates of IO vary, ranging from 0.5% to 5% based on definitions and populations studied. In cases of term pregnancies, IO often prompts consideration of labor induction. Oligohydramnios has been linked to increased perinatal risks, potentially due to issues such as umbilical cord compression and utero-placental insufficiency (6).

Doppler velocimetry, an essential tool in assessing fetal well-being, frequently focuses on the umbilical artery due to its accessibility and relevance to fetal outcomes. The umbilical artery's pulsatility index (UA-PI) reflects perfusion to the fetoplacental unit, and its alterations signify placental vascular resistance changes. An abnormal UA-PI, usually defined as exceeding two standard deviations above the mean for gestational age, may suggest fetal abnormalities (7). Additionally, the middle cerebral artery (MCA) is widely studied for its ability to gauge cerebral blood flow and direction, often assessed using the cerebroplacental ratio (CPR). CPR has shown promise as a predictor of growth-restricted fetuses and adverse perinatal outcomes (8).

Building upon existing research, we propose an exploration of significant Doppler index variations in both umbilical and middle cerebral arteries among the study groups (IUGR, oligohydramnios, and decreased fetal movement) and a control group. Our investigation aims to elucidate the potential impact of these variations on pregnancy termination decisions, intranatal preparations, mode and timing of delivery, and subsequent postnatal outcomes. While some insight into Doppler changes in the specified conditions exists, a comprehensive analysis of their influence on decision-making, mode of delivery, and overall pregnancy outcome is yet to be fully addressed. Furthermore, a comparative evaluation between study groups and a control group is warranted, emphasizing the significance of this research endeavor.

The purpose of this study was to evaluate the Doppler changes and Doppler indices in the umbilical and middle cerebral arteries and their impact on decision and mode of delivery also pregnancy outcome in cases of intrauterine growth restriction, oligohydramnios and decreased fetal movement.

Patients and methods

This comparative controlled clinical study was conducted at the Department of Obstetrics and Gynecology and the Ultrasound Unit of Banha University Hospital. The study aimed to investigate cases of intrauterine growth restriction (IUGR), decreased fetal movement (DFM), and oligohydramnios. A total of 100 pregnant women with gestational age 28 weeks or more, attending routine antenatal care, were included in the study. Informed consent was obtained from all participants between the period of January 20, 2022, to November 30, 2022.

An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Benha University (M.S.27.1.2022). The study design involved a cohort of 100 pregnant women, divided evenly into two groups: the Study Group, which consisted of 50 pregnant women diagnosed with intrauterine growth restriction (IUGR), decreased fetal movement (DFM), or oligohydramnios; and the Control Group, comprising 50 pregnant women without complications or fetal growth abnormalities, matched with the study group in terms of gestational age.

Inclusion Criteria: Participants were eligible for the study if they were aged 18 to 35 years, had a gestational age between 28 and 40 weeks, were experiencing a singleton viable pregnancy, and were diagnosed with intrauterine growth restriction (IUGR), decreased fetal movement (DFM), or oligohydramnios. In cases of decreased fetal movement, eligibility required movement counts of less than 10 within a 24-hour period from the 28th week of gestation onwards.

Exclusion criteria were multiple pregnancies, known congenital fetal malformations, antepartum hemorrhage, premature rupture of membranes, or maternal medical disorders.

Data Collection and Examination:

Data collection involved comprehensive history-taking and physical examination, including A) Personal and demographic data, including parity, maternal age, and BMI. B) Obstetric history, menstrual history, and gestational age estimation. C) Medical and surgical history of the patient and her family. D) General examination, including vital signs, maternal weight, height, and abdominal assessment.

E) Ultrasound Evaluation: Ultrasound examinations were performed using a LOGICP 5V machine equipped with color Doppler capabilities and a 3.5 MHz transducer. Ultrasound parameters assessed included:

Gestational age determination: Estimation of fetal weight and evaluation of fetal growth for IUGR cases, Fetal presentation and placental site assessment, Evaluation of amniotic fluid volume for cases of oligohydramnios.

Doppler studies were conducted for umbilical and middle cerebral arteries to assess blood flow.

Doppler assessments were performed to evaluate blood flow in the umbilical and middle cerebral arteries. The following Doppler indices were measured: Umbilical artery pulsatility index (UA-PI), Middle cerebral artery pulsatility index (MCA-PI), Cerebro-umbilical ratio (C/U ratio) was calculated as MCA-PI/UA-PI.

Laboratory Investigations: Routine laboratory tests included [Complete Blood Count (CBC), Urine analysis, Fasting Blood Sugar (FBS)].

Study Outcomes:

Primary Outcome: Cerebro-umbilical ratio measurement: A key parameter reflecting the balance between cerebral and placental blood flow, aiding in assessing fetal well-being and identifying potential risks.

Secondary Outcomes: Pregnancy outcomes: Mode of delivery (vaginal delivery, cesarean section). Neonatal outcomes: APGAR score, birth weight, and neonatal intensive care unit (NICU) admission.

APGAR Score: The APGAR score, assessed at one and five minutes after birth, evaluates newborn well-being based on five criteria: Appearance, Pulse, Grimace, Activity, and Respiration. Each criterion is scored from 0 to 2, and the scores are summed to obtain a total APGAR score (9).

Statistical analysis

Statistical analysis was done by SPSS v27 (IBM©, Armonk, NY, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by ANOVA (F) test with post hoc test (Tukey). Quantitative non-parametric data were presented as median and interquartile range (IQR) and were analyzed by Kruskal-Wallis test with Mann Whitney-test to compare each group. Qualitative variables were presented as frequency and percentage (%) and were analyzed utilizing the Chi-square test. A two tailed P value < 0.05 was considered statistically significant.

Results

There was no statistically significantly different among the studied groups as regard age, height, weight, BMI, gravidity, and parity. Gestational age at delivery was statistically significantly different among the studied groups. GA was significantly lower in IUGR group compared to Oligohydramnios, decreased movement and Control groups. GA was significantly higher in oligohydramnios group compared to decreased movement group , with no significant between oligohydramnios group and control group. GA was significantly lower in decreased movement group compared to control group.

Table

Recent abortion, Breech, previous still birth, RH negative, UTI, cord around baby neck were insignificantly different among the studied groups. Previous IUGR, anemia and NICU admission were significantly different among the studied groups**.Table 2**

Type of labour and baby weight were significantly different among the studied groups. There was a significant difference between IUGR group compared to control group with no significant difffernce between other groups. CS was significantly higher than Vaginal delivery in IUGR group, Oligohydramnios group, Decreased movement. CS was insignificantly different with Vaginal delivery in control group. Baby weight was significantly lower in IUGR group compared to Oligohydramnios ,decreased movement and control group with no significant difference between other groups. **Table 3**

Apgar score at 1 mainland 5 min were significantly different among the studied groups. Apgar score at 1 min was significantly lower in IUGR group compared to control group with no significant difference between other groups. Apgar score at 5 min was significantly lower in IUGR group compared to Oligohydramnios and control group with no significant difference with other group . Apgar score at 5 min significantly higher in control group compared to decreased foetal movement group with no difference between Oligohydramnios and both decreased movement and control group. **Table 4**

UA-PI, MCA- PI and MCA-PI /UA- PI ratio were significantly different among the studied groups. MCA- PI, and MCA-PI /UA- PI ratio were significantly lower in IUGR group, Oligohydramnios and decreased movement group compared to control group with no significant difference between IUGR and both, Oligohydramnios and decreased movement group and between, Oligohydramnios and decreased movement group. While UA-PI was significantly higher in IUGR group, Oligohydramnios and decreased movement group compared to control group with no significant difference between IUGR and both, Oligohydramnios and decreased movement group and between, Oligohydramnios and decreased movement group. **Table 5**

UA-PI, MCA- PI, MCA-PI /UA- PI ratio were significant predictors for prediction of intra uterine growth restriction, oligohydramnios and decreased fetal movement. **Figure 1**

Table 1: Baseline characteristics among the studied groups

	IUGR (n = 30)	**Oligohydramnios (n = 10)**	**Decreased movement (n=10)**	**Control group (n-50)**	**P value**
Age (year)	27.57±4.49 20-35	27.4±5.15 19-35	27.2±5.57 20-35	26.7±5.28 19-35	0.896
Height (cm)	165.53±5.26 157-175	161.9±4.07 157-170	167.3±4.79 160-174	165.24±4.64 158-174	0.086
Weight (Kg)	75.7±5 65-85	74.1±6.44 65-85	75.8±2.39 73-80	74.52±5.73 63-84	0.704
BMI (Kg/m^2)	27.71±2.65 23.88-34.05	28.36±3.3 23.88-34.05	27.17±2.29 24.1-31.25	27.35±2.51 22.72-31.25	0.667
GA at delivery (days)	246.47±7.56 238-266	284.3±5.96 273-289	271.7±6.31 259-280	280.06±8.09 266-289	**<0.001***
P value between groups	P1**<0.001***, P2**<0.001***, P3 **<0.001***, P4=**0.009***, P5=0.502, P6=**0.034***				
Gravidity	3 (2-4)	2.5 (1.25-4)	3 (2.25-4)	3 (1.25-4)	0.741
Parity	3 (1.25-3)	2 (1-2.75)	2 (1-3)	2 (1-3)	0.289

Data are presented as Mean ± SD,median (IQR),BMI: body mass index, GA: gestational age, IUGR:intrauterine growth restriction, , * significant as p value <0.05. P1: p value between IUGR and Oligohydramnios groups, P2: p value between IUGR and Decreased movement groups, P3: p value between IUGR and Control groups, P4: p value between Oligohydramnios and Decreased movement groups, P5: p value between Oligohydramnios and control groups, P6: p value between Decreased movement and control group

Table 2: Risk factors among the studied groups

	IUGR (n = 30)	Oligohydramnios (n = 10)	Decreased movement (n=10)	Control group (n-50)	P value
Previous IUGR	4 (13.33%)	0 (0%)	2 (20%)	0 (0%)	**0.017***
P value between groups	P1=0.555, P2=0.628, P3= **0.017***, P4=0.473, P5=0.080, P6=**0.025***				
Anemia	4 (13.33%)	2 (20%)	1 (10%)	2 (4%)	**0.001***
P value between groups	P1=0.628, P2=1.0, P3= **0.001***, P4=1.0, P5=0.161, P6=**0.033***				
Previous Abortion	2 (6.67%)	1 (10%)	2 (20%)	2 (4%)	0.329
Breech	3 (10%)	0 (10%)	1 (0%)	0 (0%)	0.777
Previous still birth	1 (10%)	0 (8%)	1 (0%)	0 (0%)	0.647
RH negative	1 (3.33%)	1 (10%)	0 (0%)	2 (4%)	0.708
UTI	1 (3.33%)	0 (0%)	0 (0%)	2 (4%)	0.849
Cord around baby neck	1 (3.33%)	0 (0%)	0 (0%)	2 (4%)	0.849
NICU admission	19 (63.33%)	2 (20%)	5 (50%)	0 (0%)	**< 0.001***
P value between groups	P1=**0.028*,** P2= 0.709, P3= <**0.001***, P4=0.349, P5=**0.025***, P6<**0.001***				

Data are presented as frequency (%),IUGR: intrauterine growth restriction, PIH: Pregnancy-induced hypertension, NICU :neonatal intensive care unit, UTI: urinary tract infection, * significant as p value <0.05. P1: p value between IUGR and Oligohydramnios groups, P2: p value between IUGR and Decreased movement groups, P3: p value between IUGR and Control groups, P4: p value between Oligohydramnios and Decreased movement groups, P5: p value between Oligohydramnios and control groups, P6: p value between Decreased movement and control groups.

Table 3: Type of labor and baby weight in the studied groups

		IUGR (n = 30)	Oligohydramnios (n = 10)	Decreased movement (n=10)	Control group (n-50)	P value
Type of labor	**CS**	26 (86.67%)	7 (70%)	6 (60%)	25 (50%)	**0.012***
	Vaginal	4 (13.33%)	3 (30%)	4 (40%)	25 (50%)	
P value between groups		P1 = 0.337, P2 = 0.089, P3= **0.001***, P4 =1.0, P5= 0.311, P6= 0.732				
Baby weight (gm)		2178.67±283.45 1650-2450	3340±330.66 2900-3900	3210±310.73 2800-3600	3266±344.7 2700-4200	**<0.001***
P value between groups		P1 **<0.001***, P2 **<0.001***, P3**<0.001***, P4 =0.805, P5= 0.911, P6= 0.959				

Data are presented as Mean ± SD, IUGR:intrauterine growth restriction, * significant as p value <0.05. P1: p value between IUGR and Oligohydramnios groups, P2: p value between IUGR and Decreased movement groups, P3: p value between IUGR and Control group groups, P4: p value between Oligohydramnios and Decreased movement groups, P5: p value between Oligohydramnios and control groups, P6: p value between Decreased movement and control groups.

Table 4: APGAR score in the studied groups

	IUGR (n = 30)	Oligohydramnios (n = 10)	Decreased movement (n=10)	Control group (n-50)	P value
APGAR at 1 min	8.53 ± 0.94 7-10	9±1.56 5-10	9.1±0.74 8-10	9.74±0.53 8-10	**<0.001***
P value between groups	P1=0.417, P2=0.247, P3 **<0.001***, P4=0.993, P5=0.055, P6=0.123				
APGAR at 5 min	8.67±1.27 6-10	9.6±0.52 9-10	9.1±0.88 8-10	10±0 10-10	**<0.001***
P value between groups	P1=**0.006***, P2=0.410, P3 **<0.001***, P4=0.463, P5=0.434, P6=**0.005***				

Data are presented as Mean ± SD, * significant as p value <0.05. P1: p value between IUGR and Oligohydramnios groups, P2: p value between IUGR and Decreased movement groups, P3: p value between IUGR and Control group groups, P4: p value between Oligohydramnios and Decreased movement groups, P5: p value between Oligohydramnios and control groups, P6: p value between Decreased movement and control groups.

Table 5: Fetal Doppler data in the studied groups

	IUGR (n = 30)	Oligohydramnios (n = 10)	Decreased movement (n=10)	Control group (n-50)	P value
UA-PI	0.98±0.11 0.82-1.15	1.02±0.13 0.82-1.15	0.98±0.08 0.82-1.09	0.77±0.1 0.6-0.92	**<0.001***
P value between groups	P1 =0.733, P2 =1.0, P3 < **0.001***, P4 =0.862, P5 **<0.001***, P6 < **0.001***				
MCA- PI	0.96±0.13 0.75-1.15	0.97±0.11 0.79-1.15	0.96±0.15 0.75-1.15	1.36±0.17 0.85-1.55	**<0.001***
P value between groups	P1=0.993, P2=1.0, P3 **<0.001***, P4=0.999, P5**<0.001***, P6**<0.001***				
MCA-PI /UA- PI ratio	0.99±0.2 0.68-1.4	0.96±0.13 0.72-1.15	0.99±0.22 0.75-1.4	1.8±0.31 1.03-2.4	**<0.001***
P value between groups	P1 =0.989 P2 =1.0, P3 < **0.001***, P4 =0.995, P5 **<0.001***, P6 < **0.001***				

UA-PI: Umbilical arterial pulsatility index, MCA: middle cerebral artery Data are presented as Mean ± SD, * significant as p value <0.05. P1: p value between IUGR and Oligohydramnios groups, P2: p value between IUGR and Decreased movement groups, P3: p value between IUGR and Control group groups, P4: p value between Oligohydramnios and Decreased movement groups, P5: p value between Oligohydramnios and control groups, P6: p value between Decreased movement and control groups.

Table 6: Umbilical Artery and Middle Cerebral Artery Doppler for prediction of intra uterine growth restriction, oligohydramnios and decreased fetal movement

	Cut off	AUC	Sensitivity (95%CI)	Specificity (95%CI)	PPV(95%CI)	NPV(95%CI)	P- value
UA-PI	**>0.86**	**0.926**	**84.00(70.9 - 92.8)**	**80.00 (66.3 - 90.0)**	**80.8 (70.4 - 88.1)**	**83.3 (72.3 - 90.5)**	**<0.001***
MCA- PI	**≤1.4**	**0.956**	**90.0% (78.2 - 96.7)**	**88.0% (75.7 - 95.5)**	**88.2 (77.9 - 94.1)**	**89.8 (79.2 - 95.3)**	**<0.001***
MCA-PI /UA- PI ratio	**≤1.37**	**0.0991**	92.0 (80.8 - 97.8)	**96.00 (86.3 - 99.5)**	**95.8 (85.5 - 98.9)**	**92.3 (82.4 - 96.9)**	**<0.001**

UA-PI, MCA- PI, MCA-PI /UA- PI ratio were significant

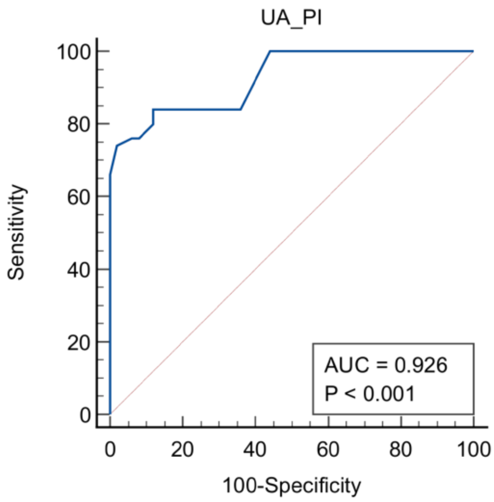

Fig. 1: Roc of UP-AI

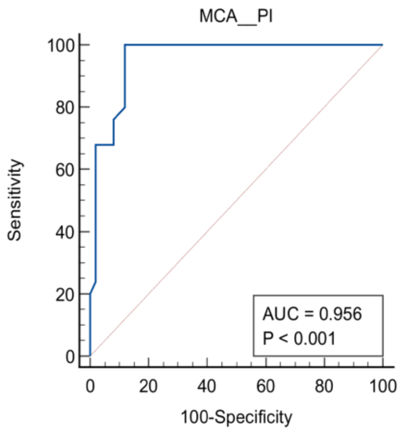

Fig. 2: Roc curve of MAC-PI

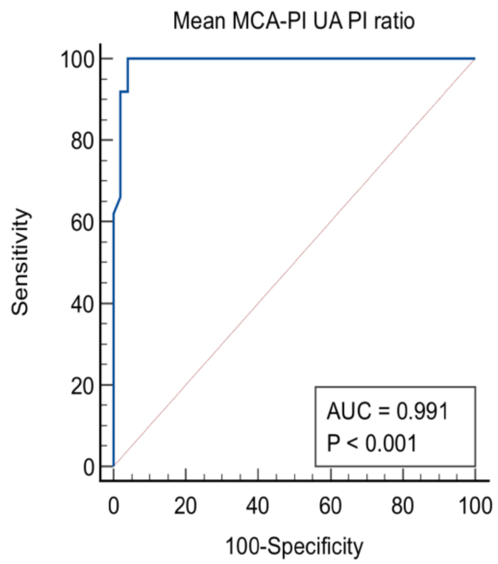

Fig. 3: ROC curve of Mean MCA-PI: UA PI ratio

Discussion

Intrauterine growth restriction (IUGR) refers to fetal growth below the normal potential for a specific infant based on race and gender. It results from reduced innate growth potential or adverse fetal effects. "Small for gestational age" (SGA) is often used interchangeably with IUGR but is based solely on birth weight percentile (10). Placental insufficiency is a common cause of IUGR, while maternal conditions and other factors indirectly contribute. Doppler ultrasound, particularly of umbilical and middle cerebral arteries, aids IUGR diagnosis and timing of delivery (11). This study assesses Doppler changes and indices in intrauterine growth-restricted cases, oligohydramnios, and decreased fetal movement to understand their impact on postnatal outcomes through umbilical and middle cerebral artery Doppler indices and cerebro-umbilical ratio assessment.

In the present study, significant differences in GA at delivery were observed among the groups. Specifically, the IUGR group exhibited significantly lower GA compared to the Oligohydramnios, decreased movement, and control groups. Furthermore, GA was significantly higher in the oligohydramnios group compared to the decreased movement group, but no significant difference was found between the oligohydramnios group and the control group. Additionally, GA was notably lower in the decreased movement group when compared to the control group.

Supporting these findings, a recent study focused on cardiac function assessment in fetuses with IUGR. The study, involving 60 singleton fetuses, utilized Doppler ultrasound to analyze blood flow velocity waveforms in various arteries. Notably, the control group displayed a significantly higher mean gestational age at delivery (38 ± 1.0 weeks) compared to the IUGR group (34 ± 0.9 weeks), confirming the impact of IUGR on gestational age (12).

Similarly, a study explored the predictive value of MCA/UA pulsatility index ratio in fetuses with preeclampsia and gestational hypertension. Neonates from mothers with abnormal MCA/UA pulsatility index ratio values exhibited significantly lower gestational age at delivery (34.8 versus 38.4 weeks), further emphasizing the relationship between Doppler indices and gestational age (13).

The current study did not observe occurrences of PIH, primary infertility, essential hypertension, antepartum hemorrhage, heart disease, DM, or jaundice in the studied groups. Similarly, recent abortion, breech presentation, previous stillbirth, RH factor, UTI, pyrexia, and cord entanglement showed no significant differences among the groups. These findings align with a study reported similar insignificant differences in these factors. Likewise, PIH, primary infertility, and antepartum hemorrhage were absent in both studies (12).

In line with our results, a study documented the absence of stillbirth or neonatal death in their study population (14). Contrarily, our study found significant differences in previous IUGR, anemia, and NICU admission among the groups, which corresponds to our findings. This concurs with a study identified significantly higher rates of NICU admission and longer NICU stays in neonates with abnormal MCA/UA pulsatility index ratios (13).

Our study revealed significant variations in the type of labor and baby weight among the groups. Particularly, the IUGR group displayed noteworthy differences in comparison to the control group, while other groups showed no significant differences. Additionally, baby weight was significantly lower in the IUGR group compared to the Oligohydramnios, decreased movement, and control groups. These findings echo those of another study that found significant differences in labor type, cesarean section rates, and neonatal birth weight between adverse outcome and control groups (14). Similarly, a study reported lower birth weights, higher perinatal death rates, and increased cesarean deliveries for fetal distress in neonates with abnormal MCA/UA pulsatility index ratios (13).

According to our study findings, significant differences were observed in Apgar scores at 1 and 5 minutes among the studied groups. Apgar scores at 1 minute were notably lower in the IUGR group compared to the control group, while Apgar scores at 5 minutes were significantly lower in the IUGR group compared to the Oligohydramnios and control groups. Furthermore, Apgar scores at 5 minutes were higher in the control group than the decreased movement group. These results align another study, which similarly demonstrated significantly lower Apgar scores at 1 and 5 minutes in the IUGR group compared to the control group (12). Similarly, a study reported a higher percentage of neonates with Apgar scores below 7 at 5 minutes in the group with abnormal MCA/UA pulsatility index ratio compared to the group with a normal ratio (13)

In our study, significant differences were also found in umbilical artery pulsatility index (UA-PI), middle cerebral artery pulsatility index (MCA-PI), and MCA-PI /UA-PI ratio among the studied groups.

MCA-PI and MCA-PI /UA-PI ratio were significantly lower in the IUGR, Oligohydramnios, and decreased movement groups compared to the control group, while UA-PI was significantly higher in the former groups compared to the control group. These findings are consistent with a study noted higher UA-PI and lower MCA-PI & MCA-PI: UA-PI ratios in the adverse outcome group compared to the normal outcome group (14).

Regarding the current work, UA-PI, MCA-PI, MCA-PI /UA- PI ratio were significant predictors for prediction of intra uterine growth restriction, oligohydramnios and decreased fetal movement.

In agreement with our results, a study found that UA-PI, MCA- PI, MCA-PI /UA- PI ratio were significant predictors for prediction of adverse perinatal outcome. In the comparison between the performances of the different Doppler indices in antepartum fetal surveillance for adverse perinatal outcome, it was found that CPR with cutoff point 1.09 had the best specificity &MCA PI with cutoff point = 1.01 had the best sensitivity (14).

Conclusion

From our findings we can conclude that Doppler changes and Doppler indices in the umbilical and middle cerebral arteries had a great impact on postnatal outcome in cases of intrauterine growth restriction, oligohydramnios and decreased fetal movement. As MCA- PI, and MCA-PI /UA- PI ratio were significantly lower in IUGR group, oligohydramnios and decreased movement group compared to control group. Also, UA-PI, MCA- PI, MCA-PI /UA- PI ratio were significant predictors for prediction of intra uterine growth restriction, oligohydramnios and decreased fetal movement.

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