Original Research Article

Cerebroplacental Doppler Indices In Intrauterine Growth Restriction Fetuses Before And After Maternal Dexamethasone Management

Abstract

Background: IUGR increases the risk for intrapartum asphyxia, preterm delivery, and risks associated with preterm delivery, including but not limited to respiratory distress syndrome, intraventricular hemorrhage, and necrotizing enterocolitis. Doppler ultrasound gives us information on the vascular resistance and, indirectly, on the blood flow. The aim of this work is to assess any change in the cerebroplacental Doppler ratio before and after receiving Dexamethasone on pregnancies complicated by fetal growth restriction.

Methods: A prospective study was conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine, Tanta University on 60 pregnant females after counseling and explaining of the procedure to patients, assurance of confidentiality, anonymity and their acceptance.

Results: the mean GA was 32 weeks and mean weigh of the fetus was 1165 kg with mean amniotic fluid index 5.85 cm.there was significant **increase** in **MCA PI** after treatment p-value <0.001. there was significant decrease in UMA PI after treatment with p-value <0.001

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- **Conclusions:** dexamethasone use in cases of IUGR is associated with significant improvement in the form of decrease in umbilical artery S/D ratio and pulsatility index..

Keywords: Cerebroplacental Doppler , Intrauterine Growth Restriction Fetuses . Maternal .Dexamethasone

Introduction:

"According to the American Congress of Obstetricians & Gynecologists ACOG, intrauterine growth restriction (IUGR) is one of the most common and complex problems in modern obstetrics. While there are several definitions of IUGR, the most widely accepted is an abdominal circumference (AC) or sonographic estimated fetal weight (EFW) <10th percentile for gestational age (GA)" [1, 2] .

"IUGR increases the risk for intrapartum asphyxia, preterm delivery, and risks associated with preterm delivery, including but not limited to respiratory distress syndrome, intraventricular hemorrhage, and necrotizing enterocolitis. Doppler ultrasound gives us information on the vascular resistance and, indirectly, on the blood flow"[3] .

"Three indices are considered to be related to the vascular resistance: S/D ratio (systolic/diastolic ratio), resistance index (RI = systolic velocity–diastolic velocity/systolic velocity), and pulsatility index (systolic velocity–diastolic velocity/mean velocity)" [3] .

In hypoxic fetuses, preferential blood flow is distributed to the brain, heart, and adrenal glands. In Doppler studies, this is reflected in decreased resistance in these three vascular beds. "The middle cerebral artery is the vessel of choice to assess the fetal cerebral circulation because it is easy to identify, has a high reproducibility, and provides information on the brain-sparing effect" [30,31]. "The circulation in the brain is normally high impedance. The middle cerebral arteries, which carry 80% of the cerebral circulation, represent" [4] .

“Major branches of the circle of Willis and are the most accessible cerebral vessels for ultrasound imaging in the fetus.In the presence of fetal hypoxemia, central redistribution of blood flow results in increased blood flow to the brain, heart, and adrenal glands, and a reduction in flow to the peripheral circulations. This blood flow redistribution, known as the brain-sparing reflex, is characterized by increased end-diastolic flow velocity (reflected by a low PI) in the middle cerebral artery” [5] .

“Doppler assessment of brain sparing can also be assessed with the cerebroplacental ratio, defined as middle cerebral artery PI/umbilical artery PI. A fetus is considered to have fetal brain sparing when this ratio is <5th percentile for gestational age” (6). “In the presence of IUGR, Doppler changes in the umbilical artery precede the decrease in cerebroplacental ratio and middle cerebral artery pulsatility or resistance index. However, middle cerebral artery Doppler waveforms are of clinical value in differentiating a growth restricted/ hypoxemic fetus from a constitutionally small/ normoxemic fetus” [6].

“Maternal administration of synthetic corticosteroids (betamethasone or dexamethasone) has been used for long time to improve fetal lung surfactant production and hasten the fetal lung maturity in women at risk for preterm birth. Corticosteroids also reduce the occurrence of respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis and overall neonatal mortality in preterm infants”[7] .

“No serious side effects have been reported after administration of corticosteroids during pregnancy, but some studies reported reduction in fetal body movements, fetal breathing movements and heart rate variation after betamethasone administration. Evaluation of fetal well-being with Doppler examination of blood flow velocity waveforms after maternal corticosteroid

administration is therefore essential to investigate the fetal hemodynamic effects of exogenous corticosteroids"(8). The aim of this work is to assess any change in the cerebroplacental Doppler ratio before and after receiving Dexamethasone on pregnancies complicated by fetal growth restriction.

Patients and Methods:

A prospective study was conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine, Tanta University on 60 pregnant females after counseling and explaining of the procedure to patients, assurance of confidentiality, anonymity and their acceptance.

❖ Inclusion criteria:

- Singleton pregnancy.
- After 28 weeks gestation or equal.
- Any gravidity and parity.
- Spontaneous pregnancy or pregnancy after assisted reproductive technique.
- Cases with hypertension with pregnancy can be included.

❖ Exclusion criteria:

- Fetuses with congenital anomaly.
- Multiple pregnancies.
- Maternal use of heparin or low dose aspirin.
- Maternal diabetes mellitus.

Intrauterine growth restriction was diagnosed by one or more then one of the following criteria[70]

1. Lag of two weeks or more between the current biometric measures and the documented crown rump length or certain last menstrual period.
2. < 5 mm increase in abdominal circumference after two weeks follow up.
3. < 200 g increase in fetal weight after two weeks follow up.
4. Trans cerebellar diameter / abdominal circumference ratio (TCD/AC) >15 %.

Selected cases were subjected to perform obstetric ultrasound to measure umbilical artery Doppler indices and middle cerebral artery Doppler indices, and then patient will receive Corticosteroids.

The corticosteroid to be used is Dexamethasone 12mg/ intramuscular every 12 hours for 48 hours.

Then Doppler indices repeated again after 12 hour of receiving last dose of dexamethasone.

Termination of pregnancy of selected cases was either due to near term pregnancy in most of cases or due to abnormal Doppler indices

All selected cases were subjected to:

a. History taking:

- Personal history: name, age, occupation and address.
- Menstrual and obstetrical history.
- Past history: diseases such as hypertension, diabetes mellitus, liver renal disease, collagen disease or any other condition that may affect fetal growth.
- Drug history: Previous forms of therapy either systemic or local.

b. General examination:

- Vital signs: Blood pressure, pulse rate and temperature.
- Complete physical examination.

c. Obstetrical examination:

- Including abdominal examination, vaginal examination (if indicated).

d. Routine laboratory investigations:

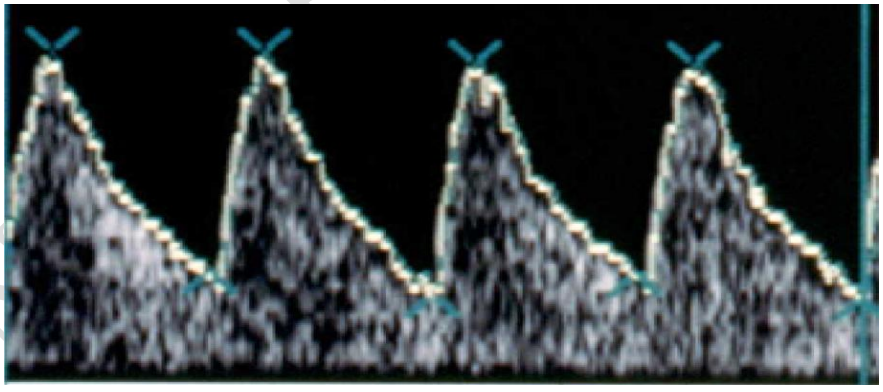
- Blood grouping and Rh typing.
- Complete blood count (CBC).
- Blood urea, serum creatinine.

- Liver function tests.
- Complete urine analysis.

e. Ultrasound examination:

- Obstetric ultrasound.
- Doppler ultrasound: Doppler study of fetal blood vessels including
- umbilical artery (UA) systolic/diastolic ratio (S/D), resistive index(RI) and pulsitility index (PI), at placental cord insertion or nearest cord to placenta was done as it is the preferred site for measurement as not influenced by fetal movement, using abdominal probe US (Ultrasound examination was performed using a Sumsung Medison Co_LTD ultrasound scanner) **figure (1).**
- Waveform should be taken in semilateral position to eliminate forced respiratory and body movements as they can lead to abnormal waveforms.

Figure 1: **Examples of umbilical artery Doppler flow Waveforms**



Data collection:

After data collection, raw data were coded and scored, and a coding instruction manual was prepared. Data were fed to the computer and statistical analysis was performed using Statistical Package for Social Sciences (SPSS 17.0) for Windows statistical software.

All data were given as mean ± standard deviation (SD) and a median to describe selected socio-demographic characteristics and clinical profile of subjects of the study as well as their ultrasonographic assessment.

Statistical analysis:

The sample size was calculated using Epi-Info software statistical package created by World Health organization and center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002. The criteria used for sample size calculation (n>33) were 95% confidence limit, 80% power of the study, expected outcome in in treatment group 90% compared to 60% for control groups.

Analysis of data were performed by SPSS v25 (SPSS Inc., Chicago, IL, USA). Quantitative parametric variables (e.g. age) were presented as mean and standard deviation (SD). They were compared between the two groups by unpaired student's t- test and within the same group by paired T test. Quantitative non-parametric variables (e.g. VAS) were presented as median and range and compared between the two groups by Mann Whitney (U) test and within the same group by Wilcoxon test. P value < 0.05 was considered significant.

Results:

This study conducted on 60 cases with following result:

Table (1): Descriptive analysis of the studied cases according demographic data (n = 60)

	Min. – Max.	**Mean ± SD.**	**Median (IQR)**
Maternal age	26.0 – 33.0	28.90 ± 2.18	28.50 (28.0 – 30.0)
Parity	0.0 – 3.0	1.50 ± 0.81	1.50 (1.0 – 2.0)
BMI (kg/m^2)	25.0 – 29.0	27.0 ± 1.10	27.0 (26.0 – 28.0)

IQR: **Inter quartile range**

This table shows that among 60 cases mean age was 28.9 years, mean BMI was 27 kg/m2 and mean parity was 1.5.

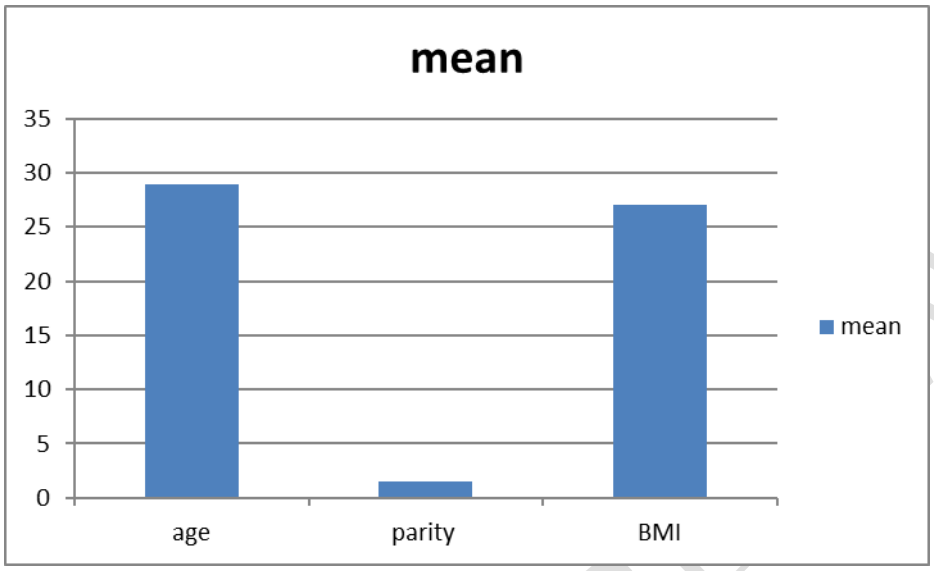


Figure 2.Descriptive analysis of the studied cases according demographic data (n = 60)

Table (2): Descriptive analysis of the studied cases according blood pressure (n = 60)

Blood pressure	Min. – Max.	Mean ± SD.	Median (IQR)
Systolic blood pressure(mHg)	130.0 – 155.0	143.5 ± 7.15	145.0(140.0 – 150.0)
Diastolic blood pressure(mHg)	80.0 – 100.0	91.0 ± 6.69	90.0(90.0 – 95.0)

IQR: **Inter quartile range**

This table shows that mean systolic blood pressure was 143.5 mmHg and mean diastolic blood pressure was 91 mmHg.

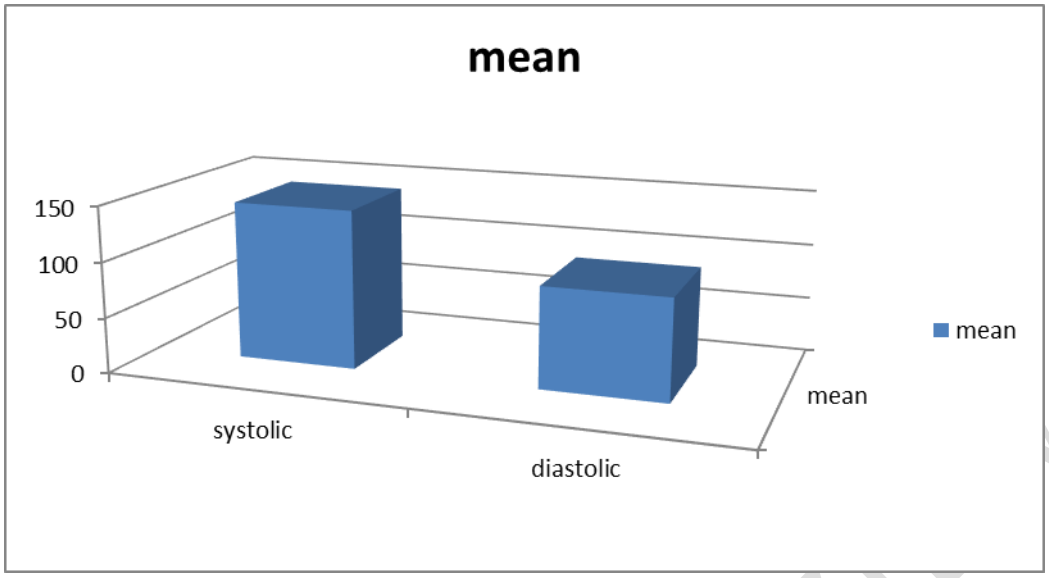


Figure 3.Descriptive analysis of the studied cases according blood pressure (n = 60)

Table (3): Descriptive analysis of the studied cases according different parameters (n = 60)

	Min. – Max.	Mean ± SD.	Median (IQR)
GA (weeks)	28.0 – 35.0	32.0 ± 2.30	32.0(30.0–34.0)
Weight (kg)	800.0 – 1550.0	1165.0 ± 237.6	1175.0(950.0–1400.0)
Amniotic fluid index (cms)	4.90 – 6.80	5.85 ± 0.55	5.95(5.40–6.20)

IQR: **Inter quartile range**

This table shows that the mean GA was 32 weeks and mean weigh of the fetus was 1165 kg with mean amniotic fluid index 5.85 cm

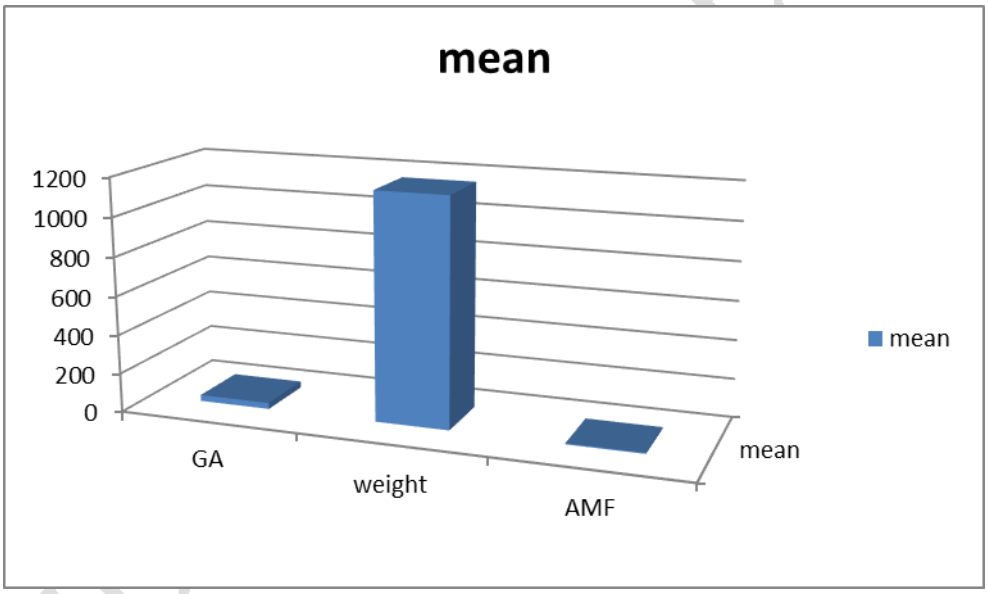


Figure 4. Descriptive analysis of the studied cases according different parameters (n = 60)

Table (4): Comparison between middle cerebral artery palstile index (MCA PI) before and after dexamethasone admnstration.

MCA PI	**Before (n = 60)**	**After (n = 60)**	**t**	**p**
Min. – Max.	1.46 – 1.60	1.49 – 1.61	5.957*	<0.001

Mean ± SD.	1.53 ± 0.04	1.54 ± 0.03		*
Median (IQR)	1.54 (1.50 – 1.55)	1.55 (1.52 – 1.56)		

t: Paired t-test IQR: **Inter quartile range**

p: p value for comparing between the studied periods

*: Statistically significant at $p \leq 0.05$

This table shows that there was significant **increase** in **MCA PI** after treatment p-value <0.001

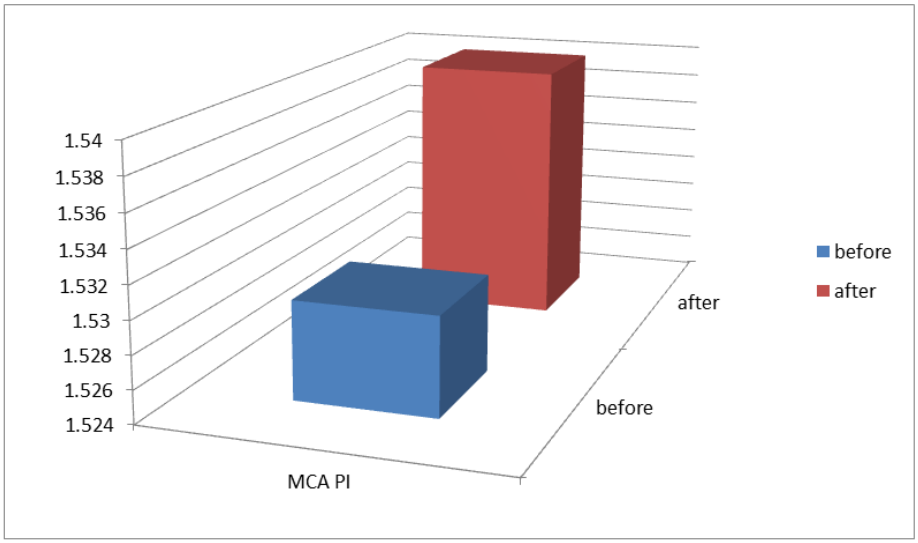


Figure 5 Comparison between MCA PI before and after dexamethasone administration.

Table (5): Comparison between Middle cerebal artery resistive index (MCA RI) before and after dexamethasone administration.

MCA RI	Before (n = 60)	After (n = 60)	t	p
Min. – Max.	0.75 – 0.79	0.77 – 0.82		
Mean ± SD.	0.77 ± 0.01	0.79 ± 0.02	12.070*	<0.001*
Median (IQR)	0.77 (0.76 – 0.78)	0.79 (0.78 – 0.80)		

t: Paired t-test IQR: **Inter quartile range**

p: p value for comparing between the studied periods

*: Statistically significant at $p \leq 0.05$

This table shows that there was significant increase in mean MCA RI after treatment p-value <0.001

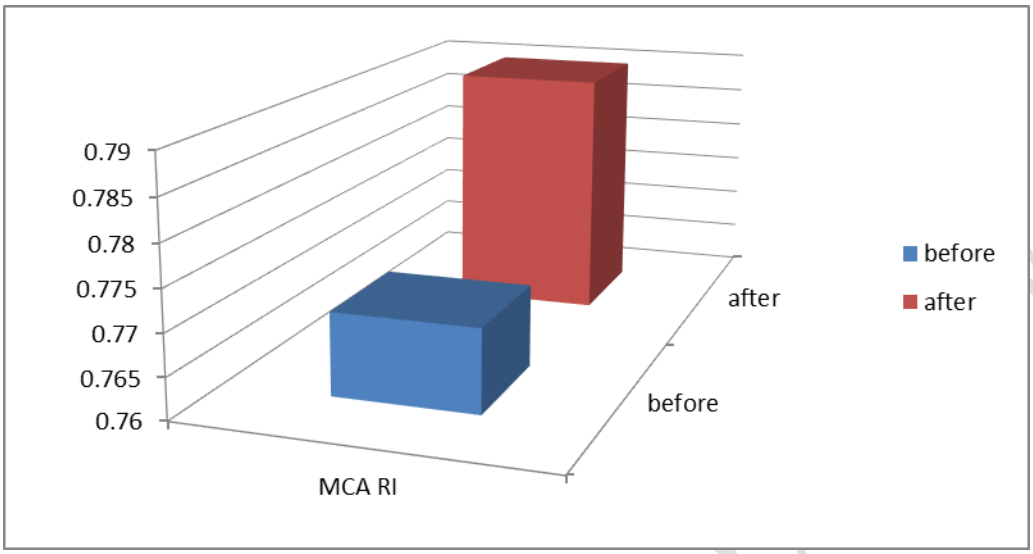


Figure 6 . Comparison between MCA RI before and after dexamethasone administration.

Table (6). Comparison between umbilical artery palstile index (UMA PI) before and after dexamethasone administration.

UMA PI	Before (n = 60)	After (n = 60)	t	p
Min. – Max.	1.33 – 1.37	1.27 – 1.34		
Mean ± SD.	1.35 ± 0.01	1.31 ± 0.02	11.357*	<0.001*
Median (IQR)	1.35 (1.35 – 1.36)	1.32 (1.31 – 1.32)		

t: Paired t-test IQR: **Inter quartile range**

p: p value for comparing between the studied periods

*: Statistically significant at $p \leq 0.05$

This table shows that there was significant decrease in UMA PI after treatment with p-value <0.001

Table (7): Comparison between umblical artery resistive index (UMA RI) before and after dexamethasone administration.

UMA RI	Before (n = 60)	After (n = 60)	t	p
Min. – Max.	0.74 – 0.76	0.71 – 0.73		
Mean ± SD.	0.75 ± 0.01	0.72 ± 0.01	35.845*	<0.001*
Median (IQR)	0.75 (0.74 – 0.76)	0.72 (0.72 – 0.73)		

t: Paired t-test IQR: **Inter quartile range**

p: p value for comparing between the studied periods

*: Statistically significant at $p \leq 0.05$

This table shows that there was significant decrease in UMA RI after treatment with p-value <0.001

Table (8): Comparison between cerbro placental ratio(CRP) before and after dexamethasone admnstration.

CPR	Before (n = 60)	After (n = 60)	t	p
Min. – Max.	1.01 – 1.07	1.04 – 1.08		
Mean ± SD.	1.04 ± 0.02	1.06 ± 0.01	12.497*	<0.001*
Median (IQR)	1.05 (1.04 – 1.06)	1.06 (1.05 – 1.07)		

t: Paired t-test IQR: **Inter quartile range**

p: p value for comparing between the studied periods

*: Statistically significant at $p \leq 0.05$

This table shows that there was significant increase in CPR after treatment p-value <0.001

Table (9): Correlation between middle cerebral artry palstile index before and after dexamethasone treatment with different parameters (n = 60)

	MCA PI			
	Before		After	
	r	p	r	p
Maternal age	0.094	0.475	0.018	0.892

Parity	0.335	0.009*	0.481	<0.001*
BMI (kg/m^2)	0.070	0.592	0.266	0.040*
Systolic blood pressure	0.212	0.103	0.265	0.041*
Diastolic blood pressure	0.140	0.287	0.258	0.046*
GA	0.835	<0.001*	0.709	<0.001*
Weight	0.663	<0.001*	0.538	<0.001*
Amniotic fluid index (cms)	0.395	0.002*	0.392	0.002*

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

This table shows that there was positive significant correlations between MCA PI before treatment with parity(p=,475) , GA(p<0.001) , weight and amniotic fluid index(p=0.002) and after treatment there was positive significant correlation with parity(p<0.001) , BMI(p=0.040) ,systolic(p=0.041) , diastolic blood pressure(p=0.046) ,GA (p<0.001), weight and amniotic fluid index (p=0.002)

Table (10):Correlation between middle cerebral artry resistive index before and after dexamethasone admnstration with different parameters (n = 60)

	MCA RI			
	Before		After	
	r	p	r	p
Maternal age	-0.451	<0.001*	-0.453	<0.001*
Parity	0.099	0.450	0.430	0.001*
BMI (kg/m^2)	0.000	1.000	-0.053	0.689
Systolic blood pressure	-0.147	0.263	-0.244	0.060
Diastolic blood pressure	0.386	0.002*	0.392	0.002*
GA	0.211	0.106	0.354	0.005*
Weight	-0.007	0.959	0.159	0.224
Amniotic fluid index (cms)	-0.088	0.503	-0.064	0.629

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

This table shows that there was negative significant correlations between MCA RI before treatment with maternal age($p<0.001$) and after treatment there was negative significant correlation with maternal age($r = -0.453$) and positive significant correlation with parity($p=0.001$), diastolic blood pressure ($p=0.002$) and GA($p=0.005$) .

Table (11):Correlation between umbilical artry PI before and after dexamethasone admnstration with different parameters (n = 60)

	UMA PI			
	Before		After	
	r	p	r	p
Maternal age	0.562	<0.001*	-0.299	0.020*
Parity	0.213	0.103	-0.728	<0.001*
BMI (kg/m^2)	0.235	0.071	-0.357	0.005*
Systolic blood pressure	0.823	<0.001*	-0.205	0.115
Diastolic blood pressure	-0.155	0.237	-0.007	0.960
GA	0.075	0.568	0.0	1.000
Weight	0.171	0.191	-0.104	0.428
Amniotic fluid index (cms)	0.126	0.337	-0.092	0.485

r: Pearson coefficient

*: Statistically significant at $p \leq 0.05$

This table shows that there was positive significant correlation between UMA PI and maternal age($p<0.001$) , systolic blood pressure($p<0.001$) and after treatment there was negative significant correlation with maternal age($r=-0.299$) , parity($r=-0.728$) , BMI ($r=-0.357$) .

Discussion

Intrauterine growth restriction (IUGR) is defined as a fetus that is at or below the 10th percentile in weight for its gestational age as adopted by the ACOG and the RCOG. Maternal habitus and physiology largely influences birth size, showing an association between height, uterine size, and blood flow. [8]

Suboptimal fetal growth is linked to adverse short and long term outcomes. Neonatal complications include haematological and metabolic problems and impaired

thermoregulation. In addition, intraventricular haemorrhage, necrotizing enterocolitis, seizures, sepsis, respiratory distress syndrome, retinopathy of prematurity and neonatal death contribute to the perinatal morbidity. [(9)]

Together with the profound perinatal impact of FGR, consequences may continue into adult life in the form of metabolic disease as a result of prenatal reprogramming and postnatal compensatory catch-up growth. It is now well established, that an adverse intrauterine environment increases disease risk in adulthood leading to metabolic syndrome, hypertension, insulin resistance and type 2 diabetes mellitus, coronary heart disease and stroke.[(10)]

The etiology of fetal growth restriction can be broadly categorized into maternal, fetal, and placental. Although the primary pathophysiologic mechanisms underlying these conditions are different, they often have the same final common pathway: suboptimal uterine–placental perfusion and fetal nutrition .[(77)]

The aim of this work was to assess any change in the cerebroplacental Doppler ratio before and after receiving Dexamethasone on pregnancies complicated by fetal growth restriction.

This study was Prospective study conducted at the Department of Obstetrics and Gynecology, Faculty of Medicine, Tanta University on 60 pregnant females diagnosed with fetal growth restriction selected from the attendees of Tanta Maternity University Hospital from January 2019 to June 2021.

We excluded from our study patients with multiple pregnancies, fetal congenital anomalies, maternal diabetes mellitus as co-morbidity and maternal use of heparin, low dose aspirin or if there is planned termination of pregnancy.

All patients underwent ultrasonography to determine gestational age and presence of IUGR and we measured the biophysical profile. Umbilical artery and middle cerebral artery Doppler ultrasonographic examination was done.

The cases were 60 pregnant women with intrauterine growth restriction (IUGR) who were offered Dexamethasone 12mg / intramuscular every 12 hours for 48 hours.

In current study we found that among 60 cases mean age was 28.9 years, mean BMI was 27 and mean parity was 1.5 , mean systolic blood pressure was 143.5 mmHg and mean diastolic blood pressure was 91mmHg , the mean GA was 32 weeks and mean weigh of the fetus was 1165 kg with mean amniotic fluid index 5.85

In comparison to Elwany E et al involve 52 participants with the mean age of the study group was 27.7±4.5 years. At the time of dexamethasone administration, mean gestational age was 30.9±2.7 weeks, and in 17 (32.7%) pregnancies, gestational age was <30 weeks [(78).]

Another study by Choudhary N et al showed that a total 77 women included in the study were between the age of 19-34 years with mean age of cases was 25.10±3.2 years . 75% of cases included in this study were between gestational age of 30-34 weeks . 27 cases (40%) were primigravida, 16 cases (24%) were 2ndgravida, 16 cases (24%) were third gravida . In this study group, 60% of multigravida women had a history of abortion, previous IUGR, intrauterine death (IUD)/still birth [(11)] .

While in the studies done by Edward et al, Robertson et al, Smolin A et al, mean gestational age on admission was 28.5 weeks, 27.8 weeks and 30.8 week srespectively.(12)

In current study there was significant increase in MCA PI after treatment p-value <0.001, there was significant increase in mean MCA RI after treatment p-value <0.001

In agreement with our result Abd El Aal HM et al showed that there was statistically significant increase in MCA in patient group after corticosteroid in comparison to before corticosteroid [(81)] .

one study reported a significant decrease in middlecerebral artery PI between day 2 and day 4 and betweenday 0 and day 4 following dexamethasone administrationin a

heterogeneous population including women with preterm labor, preeclampsia women and fetuses with chronicfetal distress .they explain The trend towards adecrease in the middle cerebral artery PI might be explained by either the physiological decrease in resistancesin the fetal brain with gestation that would be expected to be even more marked in IUGR fetuses, or the early sign of redistribution that ultimately developed in all fetuses [13]

In the other hand Elwany E et al showed that fetal MCA (RI= 0.86±0.12 and 0.83±0.13, PI= 2.19±0.72 and 2.15±0.72; p=0.001) this study didn't involved growth-restricted preterm fetuses ([78] .

While analyzing **Choudhary** N study results authors observed that fetuses with intrauterine growth restriction showed divergent response in terms of changes in umbilical artery doppler indices following antenatal betamethasone administration Significant reduction in the mean pulsatility index of umbilical artery suggesting improvement in blood flow of umbilical artery were found between 24-48 hours (day 2) after 1st dose of maternal betamethasone administration Improvement (decrease) in umbilicalartery PI was observed in 56 cases (73%) out of total 77cases where as, a subgroup of cases (21 cases) didn't show any improvement (decrease) in umbilical artery PIon day 2 following betamethasone administration. In this present study, Umbilical artery pulsatility index (PI) [14]

As in the study by Wallace and Baker, who found asignificant decrease in umbilical artery PI along with return of flow in umbilical artery in all the cases with AEDF, authors also noted that 73% cases (56 cases) with intrauterine growth restriction demonstrated an apparent improvement in umbilical artery Doppler flow parameter, as reduction in umbilical artery PI which persisted up to 4th day of 1st dose of betamethasone [15] .

Results were also comparable with the results of Thuring et al, who observed a significant decrease in umbilical PI on day 2 in 33 IUGR pregnancies and an improvement in umbilical artery flow velocity waveforms following betamethasone in cases who had AEDF or REDF before betamethasone [16] .

In current study we found that there was significant decrease in UMA PI after treatment with p-value <0.001and there was significant decrease in UMA RI after treatment with p-value <0.001

In agreement with our result Elwany E et al showed that there was a statistically significant difference between all Doppler indices in umbilical artery (PI= 1.09±0.4 and

1.05±0.39, RI= 0.66±0.14 and 0.63±0.14; p=0.001) in comparison before and 24 hours after maternal dexamethasone administration respectively [17].

"This is similarly agreed by Nozaki et al who found a reduction in the umbilical artery PI within 24 hours following antenatal corticosteroid therapy" [18] .

"In agreement with our result Abd El Aal HM et al showed that there was statistically significant decrease in UMA in patient group after corticosteroid in comparison to before corticosteroid" [19]

"This study agrees with a study made by Jain & Bindal, 2018 regarding the increase in MCA PI & RI and decrease in UMA PI & RI post corticosteroid administration in IUGR complicated pregnancies and also agrees with it regarding improvement of UMA PI in fetuses who born didn't need resuscitation than those who need" [20].

"Also the present study agrees with a previous research made by ElSonsy et al., 2017, regarding improvement of all Doppler indices of (MCA PI & RI and UMA PI & RI) after dexamethasone injection in pregnancies with great possibility of preterm labor" [21] .

"Moreover, the current study agrees with Shojaei & Mohammadi et al, 2015. regarding significant decrease in UMA PI& RI and significant increase in MCA RI and MCA-UMA-RI in IUGR fetuses with and without preeclampsia after giving betamethasone injection" [22].

"On contrary , the present study disagrees with a previous study made by Thuring et al., 2011 regarding UMA-RI, MCA-PI& RI that revealed no significant changes but in our study shows significant difference after corticosteroid administration and also disagree with it regarding significant changes in UMA waveform from REDFV to AEDFV, and from AEDFV to positive diastolic flow but in our study it shows no significant changes" [23] .

In current study we found that there was significant increase in CPR after treatment p-value <0.001

"In agreement with our result Abd El Aal HM et al showed that there was statistically significant increase in CPR in patient group after corticosteroid in comparison to before corticosteroid" [24] .

"The underlying mechanism of the alterations in the fetoplacental circulation following antenatal betamethasone administration still remains unclear. One of the possible theories to explain changes infetoplacental circulation accompanied by reduced placental resistance is

said to be because of increased secretion of placental corticotrophin releasing hormone after exogenous administration of corticosteroids, which consecutively causes nitric oxide mediated vasodilatation".[25] .

"Another possibility is related to increase in fetal blood pressure which might explain improved fetoplacental perfusion. Experimental studies have shown that administration of betamethasone to fetal sheep leads to an increase in fetal blood pressure.26Furthermore, antenatal corticosteroids treatment of pregnant women has been found to increase blood pressure levels in preterm newborn during the first days of life" [26] .

"In a recent in vitro study on human placentas, Clifton et al, concluded that the mechanism behind the dexamethasone induced vasodilatation might be an endothelium independent mechanism as they did not find any involvement of endothelium derived products like prostaglandin I2 and nitric oxide" [27].

In current study we found that there was positive significant correlations between MCA PI before treatment with parity , GA , weight and amniotic fluid index and after treatment there was positive significant correlation with parity , BMI ,systolic , diastolic blood pressure ,GA , weight and amniotic fluid index

"In agreement with our result Chitrit Y et al showed that there was significant relation between gestational age at delivery ,Birth weight(g) and MCA PI" [28].

In current study we found that there was negative significant correlations between MCA RI before treatment with maternal age and after treatment there was negative significant correlation with maternal age and positive significant correlation with parity, diastolic blood pressure and GA , there was positive significant correlation between UMA PI and maternal age , systolic blood pressure and after treatment there was negative significant correlation with maternal age , parity , BMI, that there was positive significant correlation between UMA RI and amniotic fluid index but after treatment there was negative significant correlation with maternal age and positive significant correlation with diastolic blood pressure

Choudhary N et al showed that "There was no significant correlation found between the gestational age and Doppler changes in the umbilical artery following betamethasone administration" [29] .

Conclusions:

- We concluded that dexamethasone use in cases of IUGR is associated with significant improvement in the form of decrease in umbilical artery S/D ratio and pulsatility index.
- Dexamethasone was associated with improvement in the form of increase in MCA pulsatility index in the studied group.
- Also, measurements of cerebroplacental ratio were increased at end of the study in studied group..

Ethical Approval:
The study was approved by the Ethical Committee Code32656/10/18 of the University of Tanta.

Consent :
As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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