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Predicting Perinatal Outcome through Changes in Doppler Studies after Antenatal Corticosteroids Administration in Preeclamptic Patients

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ABSTRACT

Background: New-onset gestational hypertension and proteinuria are symptoms of preeclampsia, a pregnancy complication. Both moms and their infants are affected by the illness.

Aim of the work: To assess the accuracy of Doppler indices during the third trimester in predicting fetal outcome after administration of corticosteroids in women with preeclampsia by performing antenatal Doppler indices and recording the fetal outcome after delivery.

Patients and methods: A prospective randomized controlled clinical trial with double blinding was done at El Galaa Maternity Teaching Hospital. Pregnant ladies between 32 to 36 weeks of gestation with preeclampsia who attend antenatal clinic and emergency room at El Galaa Maternity Teaching Hospital's Obstetrics and Gynecology Department.

Results: there was one case of stillbirth among Study cases. 40% of neonates of Study group were admitted to NICU versus only 2 neonates of control group, 34 % of Study cases' neonates showed RDS versus only one of control group. umbilical artery PI, RI, and S/D ratio showed significant decrease 48 hours after dexamethasone administration and then returned to baseline levels after 4 days of administration of dexamethasone.

Conclusion: Antenatal Doppler examination can identify foetuses at risk for NICU admission and morbidity after delivery, 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.

Keywords: Neonates; preeclampsia; Doppler evaluation; predicting; gestational age.

Disclosure:

ultrasound makes it easier to assess foetal cardiac blood flow and peripheral vascular trees, as well as foetal organ blood flow, placental vasculature and blood flow, and uterine cervix development. Quantitative and qualitative analyses of the vascularization and blood flow of foetal organs, the placenta, and the uterine cervix have become possible because to recent improvements in 3D power Doppler ultrasound and quantitative 3D power Doppler histogram analysis. This technique has the potential to aid in the examination of the foetal circulatory system and feto-placental function, and it has advantages over traditional two-dimensional power Doppler ultrasound assessments. Future study on foetal and placental blood flow may benefit from 3D power Doppler ultrasound, which can help with prenatal identification of foetal and placental vascular disorders.⁴

PATIENTS AND METHODS

El Galaa Maternity Teaching Hospital conducted a prospective double-blind randomised controlled clinical experiment.. Pregnant ladies between 32 to 36 weeks of gestation with preeclampsia who will attend antenatal clinic and emergency room at Obstetrics and El Galaa Maternity Teaching Hospital's Gynecology Department. A double blind randomized controlled trial performed, it will involve 100 Preeclamptic patients attending the antenatal clinic and intending to deliver at the emergency room. Doppler indices performed to the entire study sample with administration of corticosteroids to one group while the other was received placebo. Group 1 (the case group): This group consists of 50 patients receiving dexamethasone 6 mg intramuscularly 12 hours apart given in four doses between 32 weeks and 36 weeks. Group 2 (the control group): This group consists of 50 patient receiving a placebo given intramuscularly in four doses between 32 weeks and 36 weeks in the same manner. To insure that everyone has the chance of participation, randomization will be a computer-generated randomization mechanism was used Neither the patient nor the researcher will know whether they were given corticosteroids or a placebo. (This is a double-blinding approach.) The size, colour, and form of the placebo will be identical to the original.

Drug: The drug used in the study and placebo will be put in 100 numbered closed envelopes according to the table of random number and envelope will be allocated to each patient accordingly.

Inclusion criteria: Women who choose to have a lower segment caesarean section. patient presenting

with mild preeclampsia, age ranging from (20-45), gestational age between 28 to 36 Weeks (by first trimester ultrasound or documented last menstrual cycle) and the patient's formal informed permission

Exclusion criteria: venous thrombosis (DVT and/or pulmonary embolism) OR arterial thrombosis (angina pectoris, myocardial infarction, stroke), epilepsy or seizure, any known cardiovascular, renal, or liver condition, autoimmune diseases, sickle cell disease, severe hemorrhagic disease, placenta previa abruptio placenta, grossly adherent placenta severe Preeclampsia, place

Eclampsia or HELLP syndrome, patients diagnosed with IUGR and maternal or fetal condition requiring immediate delivery

Both groups will be subjected to the following:

Ultrasound and Doppler studies will be performed to both of the study groups for comparison and control. Doppler performed for both groups of women before administration of dexamethasone and twice after its administration with first reading 48 hours after dexamethasone administration and second reading after another 48 hours (4 days after administration).

History taking: history of present pregnancy (abdominal enlargement, rupture of membranes, etc.), past history of pregnancy, exclude any medical disorder (metabolic disease, Thrombocytopenia, Hypertension, Diabetes mellitus, Cardiac disease, etc.) and menstrual history (to confirm LMP and this date is reliable).

General examination: Abdominal examination with particular emphasis on abdominal enlargement, obstetric ultrasound to document viability of pregnancy and to ensure the gestational age and fetal condition and CBC or hematocrit preoperative.

Ethics: Informed consent taken from all participates before recruitment in the study after explanation of the purpose and procedures of the study.

Statistical analysis: For metric data, descriptive statistics will be descriptive statistics shall be expressed as range, median, and inter quartile range, number, and proportions for discrete data; descriptive statistics will be expressed as range, median, and inter quart

Fetal weight was significantly lower among preeclampsia cases compared to control group. There was no significant difference between serial estimations of fetal weight between both groups. Table 1

MCA		Control group	Study group	p-value \$
S/D ratio	First reading	4.42 ± 1.3	6.55 ± 2.3	<0.001*
	2 nd reading	3.7 ± 1.73	5.56 ± 1.8	<0.001*
	3 rd reading	4.3 ± 2.18	5.73 ± 2.1	0.01*
	p-value#	0.2 (NS)	0.1 (NS)	
Pulsatility index	First reading	1.18 ± 0.4	1.66 ± 0.5	<0.001*
	2 nd reading	1.07 ± 0.9	1.61 ± 0.7	0.01*
	3 rd reading	1.2 ± 0.6	1.59 ± 0.8	0.03*
	p-value#	0.7 (NS)	0.9 (NS)	
Resistive index	First reading	0.68 ± 0.1	0.78 ± 0.2	0.02*
	2 nd reading	0.71 ± 0.3	0.72 ± 0.09	0.8 (NS)
	3 rd reading	0.69 ± 0.09	0.75 ± 0.1	0.02*
	p-value#	0.8 (NS)	0.2 (NS)	

Table 2: Comparison of MCA parameters three readings in both groups

\$ p-value for unpaired t-test

p-value for analysis of variance test

NS: not statistically significant difference

*Statistically significant difference

a, b denotes significance difference within serial readings among each group (post hoc analysis, Bonferroni test)

MCA Doppler parameters (PI, RI, S/D ratio) were significantly higher among study cases compared to control group with no significant difference between serial measurements before and after dexamethasone administration among study cases. Table 2

Umbilical artery		Control group	Study group	p-value \$
S/D ratio	First reading	2.52 ± 0.9	3.91 ± 1.2 ^a	<0.001*
	2 nd reading	2.6 ± 1.04	2.81 ± 1.08 ^b	0.4 (NS)
	3 rd reading	2.4 ± 1.08	3.79 ± 1.9 ^a	0.001*
	p-value#	0.7 (NS)	0.007*	
Pulsatility index	First reading	1.42 ± 0.8	2.28 ± 1.1 ^a	<0.001*
	2 nd reading	1.39 ± 0.9	1.51 ± 0.9 ^b	0.6 (NS)
	3 rd reading	1.34 ± 1.02	2.09 ± 1.2 ^a	0.01*

RED	0	0%	28	56 %
Positive diastolic flow	50	100%	5	10%

Table 4: Comparison of blood flow pattern of umbilical artery among both groups

AED: absent end-diastolic, RED: reversed end-diastolic*statistically significant difference

Umbilical artery blood flow pattern	First reading		Second reading	
	First reading	-	First reading	-
	2 nd reading	<0.001*	2 nd reading	-
	3 rd reading	0.8 (NS)	3 rd reading	0.01*

Table 5: Comparison of blood flow pattern of umbilical artery among study group

*Statistically significant difference

NS: not statistically significant difference

Ductus venosus PI and RI significantly decreased 48 hours after dexamethasone administration and then returned to baseline levels after 4 days of administration of dexamethasone. Table 6

Ductus venosus		Control group		Study group		p-value \$
Pulsatility index	First reading	0.45 ± 0.1		0.69 ± 0.1 ^a		<0.001*
	2 nd reading	0.41 ± 0.2		0.46 ± 0.1 ^b		0.2 (NS)
	3 rd reading	0.47 ± 0.1		0.61 ± 0.2 ^a		0.001*
	p-value#	0.3 (NS)		<0.001*		
Resistive index	First reading	0.55 ± 0.09		0.71 ± 0.07 ^a		<0.001*
	2 nd reading	0.54 ± 0.08		0.55 ± 0.1 ^b		0.3 (NS)
	3 rd reading	0.56 ± 0.1		0.69 ± 0.1 ^a		0.04*
	p-value#	0.7 (NS)		<0.001*		
Negative a wave	First reading	0	0%	3	10%	0.7 (NS)
	2 nd reading	0	0%	0	0%	

the research group's umbilical artery (UA) and ductus venosus (DV) both showed significant changes.

This is in line with the findings of ⁵, who discovered a significant temporary change in the velocity waveform and a reduction in the PI in the umbilical artery and ductus venosus after administering maternal prenatal betamethasone, a nearly identical drug.

Another study found that prenatal corticosteroid medication reduced the umbilical artery and ductus venosus PI within 24 hours ⁶.

The modifications could be saved for up to 48 hours.

According to a study of the literature, corticosteroid therapy improved umbilical artery blood flow waveforms in six of 17 trials ⁷.

Two days after dexamethasone administration, alterations in the umbilical artery waveform from reversed to absent and from absent to positive diastolic flow were identified in 32 of 50 individuals.

After 4 days, the undelivered fetuses' umbilical artery and ductus venosus velocity waveforms either reverted to their pre-treatment state or degraded further.

Following betamethasone treatment, the same side effects were reported ⁵.

According to a research by Robertson et al., babies with persistent absent end-diastolic flow were more likely to require assisted breathing in utero than neonates with transitory positive end-diastolic flow ⁸.

There was no link found between postnatal morbidity and pregnancies with persistent absent/reversed diastolic flow in the research ⁵.

One explanation is that the sample size was insufficient to find such a relationship.

The study included 33 women who were pregnant with a singleton and had severe foetal growth restriction and/or preeclampsia.

The rate of postnatal respiratory difficulties (RDS) was 34% in our research of preeclampsia-complicated pregnancies, compared to 4% in the control group.

The frequency of postnatal respiratory problems was 65 percent in a study of pregnancies afflicted by severe IUGR and/or preeclampsia with abnormal Doppler findings ⁵.

In a comparable study (IUGR fetuses born before 30 weeks of gestation with absent or reversed diastolic flow in the umbilical artery received 95 percent prenatal corticosteroids), 26 (65 percent) of 40 neonates had bronchopulmonary dysplasia (BPD) ⁹.

Van Stralen et al ¹⁰ questioned whether treating prematurely growth-restricted fetuses with prenatal corticosteroids was effective in a retrospective cohort study.

The benefits of corticosteroids in terms of respiratory outcomes are still debated.

In contrast to van Stralen et al ¹¹ who found protective benefits for RDS, intraventricular haemorrhage, and death after betamethasone treatment in a group of SGA children delivered at 25 to 32 gestational weeks, Ley et al ¹¹ found protective benefits for RDS, intraventricular haemorrhage, and death after betamethasone treatment in a group of SGA children delivered at 25 to 32 gestational weeks ¹⁰. The inconsistent results could be explained by differences in treatment policies and definitions of foetal growth limitation between the studies. Wijnberger et al ¹² In a group of 55 severely IUGR fetuses, researchers looked at the effect of glucocorticoids on Doppler velocity waveforms. In severely IUGR fetuses, there was no significant change in UA-PI during the 14-day observation period, but there was a substantial increase in the UA-PI/MCA-PI ratio and in DV-PI, as well as a significant drop in MCA-PI. These changes over time are equivalent to those reported in the entire population of IUGR fetuses evaluated longitudinally and may be explained by the progressive and gradual deterioration of the foetal state ¹³. As a result of this investigation, it is possible to conclude

velocity waveforms and a decrease in PI in the umbilical artery and ductus venosus, but had no effect on uteroplacental circulation, implying that corticosteroids have a direct effect on fetoplacental circulation.

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