

ORIGINAL ARTICLE

Effect of the loading dose of magnesium sulfate on the umbilical artery doppler indices in patients with severe preeclampsia

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ABSTRACT

<p>Keywords Doppler ultrasound; Magnesium Sulfate; Fetal Umbilical Artery; Severe Preeclampsia.</p> <p>*Corresponding Author: Mohamed Ahmed Galal Mahmoud 01144090098 E-mail: mohamed2012098@gmail.com</p>	<p>Background: Preeclampsia is a hypertensive disorder of pregnancy which is one of the leading causes of maternal and perinatal mortality and pre-term delivery, especially in low and middle income countries. In women with severe PE, the use of magnesium sulfate (MgSO₄) is indicated for prevention and control of acute convulsions. Purpose: To determine the effect of the loading dose of magnesium sulfate on the umbilical artery Doppler indices in the patients with severe preeclampsia. Patients and Methods: This was prospective observational cohort study, was carried out on 50 patients at Aswan University Hospital. All patients were subjected to detailed history taking and complete physical examination. Results: There was a statistical significant difference between each of the umbilical artery Doppler RI and umbilical artery Doppler PI before and after the administration of loading dose MgSO₄ in the studied patients. The decrease in the values of Doppler parameters before and after administration of MgSO₄ was observed (p value < 0.001). Conclusion: Doppler flow tests should be included in the sonographic examination. Magnesium sulfate has a vasodilator impact on the blood vessels of the mother and fetus. Several hemodynamic modifications have been observed after using magnesium sulfate. In patients with severe preeclampsia, magnesium sulfate causes major changes in the umbilical artery Doppler indices. In patients with severe preeclampsia, magnesium sulfate should be provided.</p>
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Introduction: Preeclampsia is best described as a syndrome that only occurs during pregnancy and can impact almost all organ systems. The presence of proteinuria is still a crucial objective diagnostic criterion for preeclampsia, despite the fact that it is much more than just gestational hypertension with proteinuria..(1).

Preeclampsia, one of the most significant pregnancy problems, is treated with magnesium sulfate, a medication that is frequently used in obstetrics. In patients with severe preeclampsia, magnesium sulfate is used to avoid seizures. (2).

Doppler sonography has long been used to study fetal circulation and can offer important details about the prognosis of newborns and the health of fetuses in pregnancies that are at risk. The effect of several medicines on Doppler blood waveforms has also been done using Doppler sonography. (3).

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Materials and methods: The present study was carried out at the department of obstetrics and gynecology – at Aswan university hospital.

This study was conducted on 50 women with severe preeclampsia with the following criteria: In patient with singleton pregnancy and not in labour, gestational age ≥ 28 weeks, diagnosed as severe preeclampsia by the following criteria: elevated systolic blood pressure of ≥ 160 mmHg or elevated diastolic blood pressure of ≥ 110 mmHg, proteinuria measured as +2 or more dipstick or 24 hours urine collection with ≥ 2 grams, oliguria (less than 30ml/h) or creatinine > 1.2 mg% or laboratory findings characteristic of HELLP syndrome.

All women underwent a thorough history taking, general examination, abdominal examination, CTG, laboratory investigations, and ultrasound assessment of gestational age, fetal number, viability, presentation, position, and grade of placenta, amount of fluid, and confirmation of gestational age through measurement of the biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL), the magnesium sulfate was then administered using the following protocol: 4 grams intravenously over 20 minutes as a loading dose, followed by an intravenous infusion at a rate of 1 g/hour and maintained for a period of 24 hours, with clinical assessments every four hours. Next, umbilical artery Doppler measurements were made, and the following Doppler studies were performed: resistive index [RI], Pulsatility index [PI], and systolic/diastolic ratio [S/DR]

Statistical analysis of the data:

Microsoft Excel software was used to code, enter, and analyze historical data, basic clinical examinations, laboratory investigations, and outcome measurements. The Statistical Package for the Social Sciences (SPSS version 20.0) was then used to import the data (4). The following tests were employed to determine whether differences were significant, depending on the type of data: correlation by Pearson's correlation or Spearman's. Qualitative data are represented as numbers and percentages, while quantitative data continue to group by means and standard deviation. For numerical data with a parametric distribution, descriptive statistics were Mean, Standard deviation (SD), and range; for non-parametric data, they were Median and Interquartile Range (IQR). proportion and frequency of non-numerical information The statistical significance of the difference of a non-parametric variable between more than two research groups was evaluated using the analytical Kruskal-Wallis test..

Results:

In the present study, there was no statistically significant difference regarding age, parity, gestational age, placental aging, number of vaginal deliveries, number of CS deliveries, number of living children, number of abortions, In the patients who were the subject of the study, there was a statistically significant difference in the umbilical artery Doppler RI, umbilical artery Doppler PI, and S/DR before and after the administration of the loading dosage of MgSO₄. Before and after the administration of MgSO₄, the values of the Doppler parameters decreased (p value 0.001). Umbilical artery Doppler RI and PI values taken before and after the administration of the loading dosage of MgSO₄ were 0.69 (0.03) and 0.61 (0.03), respectively, and 1.10 (0.07) and 0.93 (0.07), respectively. The SD ratios were 3.43 (0.20) and 3.04 (0.19), respectively, before and after the administration of MgSO₄.

Table (1): Demographic data of the studied patients

Parameters	Value
Age (years)	30.58±5.79 (18.0-42.0)
Parity	2 [0.0; 4.0]
Number of Vaginal Deliveries	1 [0.0; 2.0]
Number of CS Deliveries	1 [0.0; 2.0]
Number of Living Children	2 [0.0; 3.0]
Number of Abortions	1 [0.0; 2.0]
Gestational age (weeks)	34.34±1.64 (30.0-36.0)

Table (2): Mean value of umbilical artery Doppler parameters measured before and after loading dose of MgSO₄ in the studied patients

Umbilical Artery Parameters	U/A Doppler Before treatment	U/A Doppler After treatment
	Mean± SD (Range= Min. - Max.)	
RI (Resistance index)	0.69 ± 0.03 (0.63 - 0.73)	0.61 ± 0.03 (0.57 - 0.67)
PI (Pulsatility index)	1.10 ± 0.07 (0.98 - 1.20)	0.93 ± 0.07 (0.83- 1.07)
SDR (Systolic/ diastolic ratio)	3.43 ± 0.20 (2.91- 3.70)	3.04 ± 0.19 (2.58- 3.35)

Table (3): Mean value of umbilical artery Doppler parameters measured before and after loading dose of MgSO₄ in the studied patients

Umbilical Artery Parameters	U/A Doppler Before treatment	U/A Doppler After treatment	Mean Paired Differences	95% CI of the Difference	t value	P value*
	Mean± SD					
RI (Resistance Index)	0.69 ± 0.03	0.61 ± 0.03	0.079±0.02	0.072-0.086	22.982	<0.001
PI (Pulsatility Index)	1.10 ± 0.07	0.93 ± 0.07	0.17±0.06	0.152-0.185	20.900	<0.001
SDR (Systolic/Diastolic Ratio)	3.43 ± 0.20	3.04 ± 0.19	0.39±0.06	0.371-0.406	44.130	<0.001

Discussion:

Preeclampsia is a pregnancy disorder that has a wide-ranging impact on the body. Additionally, it is regarded as the world's top cause of maternal and fetal morbidity. The disorder's primary clinical symptoms are hypertension and proteinuria, which start to appear after 20 weeks of pregnancy in pregnant women who have never experienced hypertension previously (5). In the present study it was found that the umbilical artery PI values before and after the intervention were 1.10 (±0.07) and 0.93 (±0.07), respectively. The umbilical artery S/D ratios before and after the intervention were 3.43 (±0.20) and 3.04 (±0.19), respectively. The umbilical artery RI values before and after the intervention were 0.69 and 0.61, respectively, indicating a statistically significant decrease (P< 0.001).this is consistent with the study done by **Gad et al (6)** who reported mean values PI of umbilical artery before and after were 1.15 and 0.96 respectively, the before and after SD ratios were 3.35 and 3.09 respectively, the before and after RI mean values were 0.66 and 0.61 respectively. these results are consistent with the study performed by **Hefila et al (7)**. who found mean values PI of umbilical artery before and after were 1.09 and 0.92 respectively, the before and after SD ratios were 3.30 and 3.06 respectively, the before and after RI mean values were 0.67 and 0.59 respectively. These results copy with the study performed by **Souza et al (3)** who found mean values PI of umbilical artery before and after were 1.07 and 0.98 respectively, the before and after SD ratios were 3.49 and 3.1 respectively, the before and after RI mean values were 0.72 and 0.62 respectively.

Conclusion This study concluded that diagnosing abnormalities and evaluation of fetal well-being in pregnant women with preeclampsia, clinical examinations should be backed up and verified by laboratory tests and ultrasonography. Doppler flow tests should be included in the sonographic examination. Magnesium sulfate has a vasodilator impact on the blood vessels of the mother and fetus. Several hemodynamic modifications have been observed after using magnesium sulfate. In patients with severe preeclampsia, magnesium sulfate causes major changes in the umbilical artery Doppler indices so in patients with severe preeclampsia, magnesium sulfate should be provided.

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