Study of Management of Pregnancy Induced Hypertension by Magnesium Sulfate and a Calcium Channel Blocker in Central India

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ABSTRACT

Background: Pregnancy-induced hypertension (PIH) is a leading cause of high-risk pregnancy and is detrimental to both mother and the child. Hence this study was undertaken to study the effect of magnesium sulfate combined with calcium channel blocker in the management of pregnancy-induced hypertension.

Methodology: A total of 120 pregnant women admitted with PIH in the Department of OBGY in a tertiary hospital from October 2019 to April 2020 were randomly divided into the control group (60 cases) and the observation group (60 cases). The observation group was treated by magnesium sulfate along with a calcium channel blocker; i.e. nifedipine, while the control group was treated by only magnesium sulfate.

Results: The 120 patients were divided into 2 groups of 60 each and the effective rate of the observation group was 95%, higher than 81.67% of the control group, and the difference was statistically significant ($P < 0.05$). Both systolic and diastolic blood pressure in the observation group were found to be decreased which was better than that in the control group, and the difference was statistically significant ($P < 0.05$).

Conclusion: PIH can be more effectively managed by a combination of Magnesium sulfate with a CCB like nifedipine.

Key Words: Magnesium sulfate, CCB, PIH, Nifedipine, Systolic blood pressure, Diastolic blood pressure

INTRODUCTION

Pregnancy-induced hypertension can be defined as a syndrome of conditions that occurs after 20 weeks of pregnancy characterized by an increase in blood pressure to more than 140/90 mm of Hg with or without proteinuria. Causes of Pregnancy-induced hypertension include placental ischemia, a decline in immunity and heredity of pregnant women.¹⁻³ It is mainly characterized by hypertension, edema, proteinuria, and later even convulsions, coma, cerebrovascular accidents, placental abruption, fetal distress, intrauterine death and heart and kidney failure.^{4,5}

Pregnancy-induced hypertension has a morbidity of 9.4%⁶ in China and 1%~12% abroad.⁷ It can have deleterious effect on the health of mothers and infants. It is one of the major causes of morbidity and death of mothers and also the neonate. Hence, as soon as the diagnosis is made an effective treatment is started. The most commonly used magnesium

sulfate alone has been unable to achieve the desired results. Recently, the combination of magnesium sulfate with a calcium channel blocker i.e. nifedipine has been tried and has been found to achieve good results.^{8,9} Hence, the current study was aimed to study the effect of magnesium sulfate in combination with a calcium channel blocker in the management of pregnancy-induced hypertension in a tertiary hospital in Central India.

METHODOLOGY

It was an experimental study (Ethical no-DMIMS (DU)/IEC/2020/8852) with a prospective design in which a total 120 pregnant women who were admitted with Pregnancy-induced hypertension to our hospital from October 2019 to April 2020 were divided into the control group and observation group randomly with 60 patients in each group. The

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sample size was determined using the formula $n=2*[(\alpha+\beta)\sigma/\delta]^2$, and it came out to be 120.

Inclusion criteria

All pregnant women who satisfied the diagnostic criteria of Obstetrics and Gynecology¹² and had clinical manifestations such as edema feet, proteinuria, and hypertension after 20 weeks of pregnancy were included.

Exclusion criteria

Pregnant women with severe heart, liver and kidney dysfunction, nephritis, diabetes mellitus, or essential hypertension were excluded. 60 patients in the observation group received magnesium sulfate as per management protocols along with 10mg tablets of nifedipine 3-4 times a day for 7 days while 60 patients in the control group only received magnesium sulfate as per the management protocol for 7 days. The ethics committee of our hospital approved this study. All the selected pregnant women signed the informed consent.

Treatment outcome

The treatment was found to be substantially successful when the diastolic pressure and systolic pressure decreased to normal edema levels was disappeared and urine protein levels returned to the normal range. The drug was deemed successful because after drug the diastolic pressure and systolic pressure decreased significantly, and the protein of the oedema and urine increased significantly. The procedure was considered unsuccessful because there was no apparent drop in blood pressure following treatment and no noticeable change in the edema and urine protein. The general effective rate model: overall effective rate = (number of significantly effective cases + number of effective cases)/total number of cases $\times 100\%$.

STATISTICAL ANALYSIS

The data was processed using version 23.0 of SPSS. Measurement data was represented as Mean $\pm$ SD; the comparison was made using the t-test between classes. Enumeration data were expressed as the rate (percentage); the comparison was made using the Chi-square test between groups. $P<0.05$ was known as being statistically important.

RESULTS

The 120 patients were divided into 2 groups of 60 each. 60 patients in the observation group aged 20-43 years (average 26.8 ± 3.1 years) had 24-36 weeks of gestation (average 29.6 ± 4.5 weeks). There were 32 primipara and 28 multipara. There were a total of 27 cases of mild pre-eclampsia, 22 cases of moderate pre-eclampsia, and 11 cases of severe

pre-eclampsia. 60 patients in the control group aged 21-39 years (average 27.2 ± 3.9 years) and had 25-35 weeks of gestation (average 29.5 ± 4.5 weeks). There were 33 primipara and 27 multipara. There were 25 cases of mild preeclampsia, 23 cases of moderate preeclampsia, and 12 cases of severe preeclampsia. (Table 1)

The overall effective rate of the observation group was 95%, which was significantly higher than 81.67% in the control group; the difference was statistically significant ($P<0.05$), (Table 2).

Upon diagnosis, blood pressure in both groups decreased relative to that before diagnosis, and increased of both the systolic and diastolic blood pressure in the observation group was significantly higher than that in the control group ($P<0.05$), (Table 3)

The blood viscosity, urine protein, S/D and RI after treatment decreased in both the groups however the decrease of blood viscosity, urine protein, S/D and RI in the observation group was greater than that in the control group and the difference was significant ($P<0.05$), (Table 4)

DISCUSSION

We conducted a study on a total of 120 admitted pregnant women having pregnancy-induced hypertension which were divided into 2 groups of 60 each. The observation group included 60 women who were given a combination of magnesium sulfate plus a calcium channel blocker i.e. nifedipine and control group included 60 women who were treated by only magnesium sulfate.

The age groups and the parity status were comparable between the two groups. We found that the average successful performance of the observation group was higher than that of the control group, comparable to the findings of the investigations of Pasaribu et al.¹⁰ pregnancy induced hypertension is a common gynecological and obstetric disease.^{11,12} The treatment for it currently includes spasmolysis, pressure reduction, and cardiac load reduction, and magnesium sulfate is the preferred main drug.¹³ Magnesium sulfate as a spasmolytic drug contains magnesium ions that can prevent the release of acetylcholine from the motor nerve-muscle junction to block the nerve-muscle junction signal transduction and alleviate muscle contraction proven to be a good effect in the treatment of eclampsia.¹⁴ It acts this has a significant antihypertensive effect on the vascular smooth muscle to expand the peripheral blood vessels and can reduce blood pressure in a short time, alleviating cardiac insufficiency in pregnant women.¹⁵ However, clinically it is seen that blood pressure is prone to rebound after drug withdrawal,¹⁶ which could not be verified in this study as the follow-up time was too short.

As a sustained release tablet, Nifedipine acts as a long-acting calcium antagonist whose main function is to dilate the coronary arteries, increase the blood flow of patients' coronary artery, relax the smooth muscle inside the vessels, and achieve the goal of stabilizing the concentration of drugs.¹⁷ The sustained-release tablets can also enter the transmembrane transport of myocardium and smooth muscle cells of patients through calcium ions and selectively inhibit the cells and relax the smooth muscle inside the blood vessels, thereby reducing blood pressure and systolic blood pressure.^{18,19} Also it is found that it has significantly better antihypertensive effect compared to other angiotensin-converting enzyme inhibitors and is safer compared to other angiotensin-converting enzyme inhibitors. A study has shown that magnesium sulfate combined with a calcium channel blocker like nifedipine can effectively encourage smooth muscle relaxation, effectively decrease blood pressure, and boost fetal nutrition.²⁰ Results of this study have also shown that nifedipine in combination is more effective than nifedipine, decrease in both the systolic and diastolic B.P in the observation group was more obvious than those of the control group, indicating that nifedipine combined with magnesium sulfate had a significant effect in the treatment of Pregnancy-induced hypertension controlling the blood pressure. This study also found that the factors like plasma viscosity, proteinuria level, S/D and RI of the observation group were significantly lower than those in the control group after treatment, thus indicating that nifedipine combined with magnesium sulfate could effectively alleviate patient symptoms which were consistent with previous study results.²¹ Many articles reflect on related aspects of hypertension²²⁻³⁰.

CONCLUSION

Magnesium sulfate in combination with a calcium channel blocker like nifedipine can effectively control blood pressure, reduce plasma viscosity, and urine protein quantity much better than magnesium sulfate alone. Hypertension during pregnancy is a common pregnancy complication and one that is associated with severe maternal and fetal morbidity and mortality. The key problem in the management of pregnancy hypertension is to strike a balance between the maternal advantages of enhanced BP regulation and the fetal risks of intrauterine toxicity and potential uteroplacental hypoperfusion.

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Table 1: Showing distribution of characteristics in the study population:

Characteristic	Observation group (N=60 patients)	Control group (N=60 patients)
Mean age	26.8 ± 3.1 years	27.2 ± 3.9 years
Parity:		
Primipara	32	33
Multipara	28	27
Preeclampsia grade:		
Mild	27	25
Moderate	22	23
Severe	11	12

Table 2: Showing effectiveness of treatment between the two groups (n%).

Group	Observation group	Control group	X ² value	P value
Significantly effective	33 (55)	28 (46.67)		
Effective	24 (40.0)	21 (35)		
Ineffective	3 (5)	10 (16.67)		
Overall effective	57 (95)	49 (81.67)	7.68	<0.05

Table 3: Showing blood pressure level between the two groups (in mm Hg).

Group	Observation group (Mean)	Control group (Mean)	P value
Diastolic blood pressure:			
Prior treatment	119.52±10.42	110.55±10.24	P value<0.05
Post treatment	89.23±6.54	99.77±6.87	
Systolic blood pressure:			
Prior treatment	172.5±15.55	171.26±15.36	P value<0.05
Post treatment	122±10.57	138.58±10.22	

Table 4: Showing Changes of blood viscosity, urine protein, S/D and RI in two groups.

Group	Observation group	Control group	P value
Blood viscosity			
Prior treatment	4.63±1.13	4.81±1.22	P value<0.05
Post treatment	2.21±0.53	3.22±0.96	
24 hour urine protein			
Prior treatment	2.51±0.39	2.52±0.36	P value<0.05
Post treatment	1.07±0.24	1.97±0.22	
S/D			
Prior treatment	2.72±0.31	2.73±0.32	P value<0.05
Post treatment	1.78±0.33	2.44±0.38	
RI			
Prior treatment	0.58±0.05	0.57±0.06	P value<0.05
Post treatment	0.28±0.04	0.47±0.04	