

# Effect of Magnesium Sulfate Combined with Labetalol in the Treatment of Pregnancy-Induced Hypertension and Its Impact on Adverse Pregnancy Outcomes

Yanhua Du\*

Qijing Maternal and Child Health-care Hospital, Qijing 655000, Yunnan Province, China

\*Corresponding author: Yanhua Du, 15391498366@163.com

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**Abstract:** *Objective:* To investigate the effect of magnesium sulfate combined with labetalol in treating hypertension in pregnancy (HIP) and its impact on adverse pregnancy outcomes. *Methods:* A total of 150 HIP patients treated at the Qijing Maternal and Child Healthcare Hospital from June 2020 to June 2023 were randomly assigned using the lottery method. They were divided into the control group (treated with magnesium sulfate alone, 75 cases), and the intervention group (magnesium sulfate + labetalol combined treatment, 75 cases). Blood pressure levels, total adverse reaction rates, total adverse pregnancy outcome rates, and total adverse fetal outcome rates were compared between the two groups. *Results:* Compared to the control group's diastolic ( $87.94 \pm 4.86$  mmHg) and systolic ( $138.52 \pm 9.23$  mmHg) blood pressures, the intervention group showed lower levels of diastolic ( $78.95 \pm 3.57$  mmHg) and systolic ( $129.88 \pm 7.47$  mmHg) blood pressures ( $P < 0.05$ ). The intervention group exhibited a lower total adverse reaction rate (4.00%) compared to the control group (14.67%;  $P < 0.05$ ). Similarly, the total adverse pregnancy outcome rate in the intervention group (4.00%) was significantly lower than that in the control group (18.67%;  $P < 0.05$ ). Furthermore, the total adverse fetal outcome rate in the intervention group (6.67%) was lower than that in the control group (22.67%;  $P < 0.05$ ). *Conclusion:* The combination of magnesium sulfate and labetalol demonstrates significant efficacy in treating HIP. It effectively lowers blood pressure, improves pregnancy and fetal outcomes, is highly safe, and deserves promotion and application.

**Keywords:** Magnesium sulfate; Labetalol; Pregnancy-induced hypertension; Effect; Adverse pregnancy outcomes

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## 1. Introduction

Hypertension in pregnancy (HIP) refers to the occurrence of transient hypertension after 20 weeks of pregnancy, which typically resolves after delivery<sup>[1,2]</sup>. HIP is a pregnancy-specific condition and represents a significant contributor to morbidity and mortality among pregnant women and perinatal infants. Patients often experience symptoms such as hypertension, proteinuria, and edema, adversely affecting their quality

of life and pregnancy outcomes<sup>[3,4]</sup>. Therefore, it is crucial to initiate early treatment for HIP patients, often involving drug treatment. While magnesium sulfate is commonly employed in the treatment of HIP, its effectiveness is not always optimal<sup>[5,6]</sup>. Labetalol, an antihypertensive drug suitable for various hypertensive conditions, can be combined with magnesium sulfate to synergistically enhance the antihypertensive effect. To elucidate the practical value of magnesium sulfate + labetalol in managing HIP, this study aims to investigate the impact of this combination on 150 HIP patients. The findings will serve as a reference for clinical HIP treatment.

## 2. Materials and methods

### 2.1. General information

The research commenced in June 2020 and completed in June 2023. The study focused on 150 HIP patients admitted to the Qijing Maternal and Child Healthcare Hospital. A lottery method was employed to conduct a group study, with 75 HIP patients selected as the intervention group and another 75 as the control group.

The control group consisted of individuals aged between 21 and 34 years old, with an average age of  $27.33 \pm 2.45$  years. The gestational age ranged from 28 to 40 weeks, and an average of  $35.67 \pm 2.15$  weeks. Of the participants, 34 were primiparous, and 41 were multiparous. The body mass index (BMI) ranged from 18.64 to 30.43 kg/m<sup>2</sup>, with an average BMI of  $23.64 \pm 2.18$  kg/m<sup>2</sup>.

The intervention group included individuals aged 20 to 36 years old, with an average age of  $27.64 \pm 2.58$  years. Gestational age ranged from 27 to 40 weeks, with an average of  $36.05 \pm 2.08$  weeks. Of the participants, 39 were primiparous, and 36 were multiparous. The BMI ranged from 18.33 to 30.68 kg/m<sup>2</sup>, with an average BMI of  $23.75 \pm 2.24$  kg/m<sup>2</sup>.

A comparison of the two sets of data revealed  $P > 0.05$ , indicating the data were comparable. The research data have been submitted to the ethics committee, and the study commenced upon approval.

Inclusion criteria included: (1) Patients confirmed to have HIP after examination; (2) Patients with relatively complete medical records; (3) Patients with singleton pregnancy; (4) Patients experiencing the first onset of disease; (5) In addition to hypertension symptoms, mild edema, proteinuria, and urinary symptoms were present; (6) Patients who were informed and agreed to participate.

Exclusion criteria included: (1) Patients with severe impairment of heart, kidney, liver, and lung function; (2) Patients with a history of antihypertensive drug treatment before enrollment; (3) Patients allergic to the drugs used in the study; (4) Patients with multiple births or malformations; (5) Patients with cognitive impairment; (6) Patients with mental illness; (7) Patients with heart failure.

### 2.2. Methods

The control group received magnesium sulfate (Yangzhou Zhongbao Pharmaceutical Co., Ltd.; National drug approval number: H32024805; Specifications: 10 mL:2.5 g injection) as treatment. Initially, 20 mL of magnesium sulfate was dissolved in a 100 mL glucose solution with a concentration of 5%. After thorough mixing, an intravenous infusion was administered, with an infusion time of 30 minutes. Subsequently, 60 mL of the magnesium sulfate solution was dissolved in 500 mL of glucose solution with a 5% concentration. Intravenous infusion was then continued once a day. After 7 days of treatment, side effects of magnesium sulfate during treatment were monitored.

The intervention group received a combination of magnesium sulfate (same as the control group) and labetalol (Jiangsu Desano Pharmaceutical Co., Ltd.; National drug approval number: H32026119; Specifications: 0.1 g × 15 tablets × 2 tablets per day). Labetalol was taken orally, twice a day, with a single dose

of 0.1 g. After taking the medicine for 2–3 days, the dosage was increased to 0.2–0.4g, maintaining a twice-daily frequency for 7 days.

### 2.3. Observation indicators

- (1) Blood pressure indicators: Diastolic blood pressure and systolic blood pressure. The normal range for diastolic blood pressure is 60–89 mmHg, while the normal range for systolic blood pressure is 90–139 mmHg.
- (2) Adverse reactions: Dry mouth, facial flushing, nausea and vomiting, and constipation.
- (3) Adverse pregnancy outcomes: Pregnancy termination, abnormal labor, placental abruption, and postpartum infection.
- (4) Adverse fetal outcomes: Perinatal mortality, premature birth, low birth weight, fetal distress, and birth asphyxia.

### 2.4. Statistical processing

Statistical analysis was conducted using SPSS 22.0. Measurement data are presented as mean  $\pm$  standard deviation (SD), and the *t*-test is applied. Count data are expressed as rates, and the  $\chi^2$  test is employed. A significance level of  $P < 0.05$  indicates a statistically significant difference.

## 3. Results

### 3.1. Compare the blood pressure of the two groups

Before treatment, the blood pressure index levels between the two groups were insignificant ( $P > 0.05$ ). After treatment, the interventional group had significantly lower blood pressure indices as compared to the control group ( $P < 0.05$ ), as shown in **Table 1**.

**Table 1.** Blood pressure index levels of the two groups (mean  $\pm$  SD, mmHg)

Group	<i>n</i>	Diastolic blood pressure		Systolic blood pressure	
		Before treatment	After treatment	Before treatment	After treatment
Control group	75	96.37 $\pm$ 5.28	87.94 $\pm$ 4.86 *	167.49 $\pm$ 9.56	138.52 $\pm$ 9.23 *
Intervention group	75	96.42 $\pm$ 5.36	78.95 $\pm$ 3.57 *	168.12 $\pm$ 9.68	129.88 $\pm$ 7.47 *
<i>t</i>	-	0.058	12.911	0.401	6.302
<i>P</i>	-	0.954	< 0.001	0.689	< 0.001

\* $P < 0.05$  when compared to the same group before treatment

### 3.2. Compare the adverse reactions of the two groups

**Table 2** shows that the total adverse reaction rate was lower in the intervention group than in the control group ( $P < 0.05$ ).

**Table 2.** Adverse reaction rate of two groups [*n* (%)]

Group	<i>n</i>	Dry mouth	Facial flushing	Nausea and vomit	Constipation	Total
Control group	75	5 (6.67)	2 (2.67)	3 (4.00)	1 (1.33)	11 (14.67)
Intervention group	75	2 (2.67)	0 (0.00)	1 (1.33)	0 (0.00)	3 (4.00)
$\chi^2$						5.042
<i>P</i>						0.025

### 3.3. Compare the adverse pregnancy outcomes between the two groups

Table 3 shows that the adverse pregnancy outcome rates in the intervention group were lower than the control group ( $P < 0.05$ ).

**Table 3.** Adverse pregnancy outcome rates in the two groups [ $n$  (%)]

Group	$n$	Pregnancy termination	Abnormal labor	Placental abruption	Postpartum infection	Total
Control group	75	5 (6.67)	4 (5.33)	3 (4.00)	2 (2.67)	14 (18.67)
Intervention group	75	1 (1.33)	2 (2.67)	0 (0.00)	0 (0.00)	3 (4.00)
$\chi^2$						8.027
$P$						0.005

### 3.4. Compare the adverse fetal outcomes between the two groups

Table 4 shows that the adverse fetal outcome rates in the intervention group were lower than the control group ( $P < 0.05$ ).

**Table 4.** Adverse fetal outcome rates in the two groups [ $n$  (%)]

Group	$n$	Perinatal mortality	Premature birth	Low birth weight	Fetal distress	Birth asphyxia	Total
Control group	75	3 (4.00)	5 (6.67)	4 (5.33)	2 (2.67)	3 (4.00)	17 (22.67)
Intervention group	75	1 (1.33)	1 (1.33)	1 (1.33)	1 (1.33)	1 (1.33)	5 (6.67)
$\chi^2$							7.671
$P$							0.006

## 4. Discussion

HIP is not only a disease unique to pregnancy but also relatively common. The clinical characteristics include hypertension, proteinuria, edema, coma, convulsions, etc., and can even lead to the death of mother and child. The reason may be that the spasm of renal blood vessels causes swelling of endothelial cells, increasing the permeability of cells. This causes glomeruli to expand, leading to damage to the endothelial cell basement membrane, substantial protein loss, and the formation of proteinuria. It can also induce coagulation disorders, pulmonary edema, convulsions, placental villous lesions, bleeding, and other diseases<sup>[7,8]</sup>. HIP not only affects the health of pregnant women but can also cause decreased placental perfusion and endothelial damage, leading to acute atherosclerosis in placental blood vessels<sup>[9,10]</sup>. Clinical treatment for HIP patients mostly relies on sedation, antihypertensive, and antispasmodic treatment principles, with drug treatment as the mainstay<sup>[11,12]</sup>.

Magnesium sulfate is a commonly used drug for lowering blood pressure. The magnesium ions in the drug have an inhibitory effect on central nervous activity, effectively inhibiting the release of acetylcholine and disconnecting the conduction between nerves and muscles. This action relieves muscle contraction. Magnesium sulfate promotes the relaxation of vascular smooth muscles, and dilates the spasmed peripheral blood vessels of HIP patients, thereby lowering blood pressure. It can also prevent and treat eclampsia during pregnancy. In addition, magnesium sulfate has an inhibitory effect on the contraction of uterine smooth muscles, which is beneficial for improving pregnancy outcomes<sup>[13]</sup>. Magnesium sulfate must be mixed with a glucose solution, which can easily cause adverse reactions such as dry mouth and facial flushing. Rapid intravenous injection can also cause adverse reactions such as dizziness, nausea, and vomiting.

Labetalol is a beta-blocker that can highly selectively block alpha and beta receptors. It has a rapid

antihypertensive effect, is highly safe, and has a relatively small impact on heart rate. Labetalol blocks alpha receptors, producing vasodilation, participating in the antihypertensive mechanism, and slowing down the heart rate. This action reduces myocardial oxygen consumption, relieves the cardiac load, reduces peripheral vascular resistance, and, in turn, supine blood pressure. When in combination with magnesium sulfate, labetalol can have a synergistic effect, lowering blood pressure through different pathways. This enhances efficacy and reduces the dosage of magnesium sulfate according to the improvement of the condition of HIP patients. This reduction helps minimize the accumulation of pharmacological toxicity of magnesium sulfate, not only reducing adverse reactions but also ensuring the safety and health of mothers and infants.

Among the result data obtained in this study, compared with the control group treated with magnesium sulfate alone, the diastolic and systolic blood pressure levels after treatment were lower in the intervention group treated with magnesium sulfate + labetalol. This suggests that the combination of magnesium sulfate and labetalol treatment can improve the antihypertensive effect. In the study by Ruan and Chen <sup>[14]</sup>, the control group was treated with nifedipine + magnesium sulfate, while the research group was treated with labetalol + magnesium sulfate. After 4 weeks, the blood pressure indicators were compared, and it was found that the systolic and diastolic blood pressure of the research group were both lower than that of the control group, indicating a better antihypertensive effect of labetalol + magnesium sulfate. This is consistent with the results of this study.

In this study, compared with the control group, the total adverse reaction rate was lower in the intervention group, indicating that the additional labetalol treatment can reduce adverse reactions and is safer. The intervention group was also found to have a lower total adverse pregnancy outcome rate and total adverse fetal outcome rate as compared to the control group, indicating that the combination of the two drugs has a more obvious effect on improving adverse pregnancy outcomes and adverse fetal outcomes. In Chen's study <sup>[15]</sup>, the magnesium sulfate group was given magnesium sulfate, and the labetalol group was given labetalol + magnesium sulfate. The number of adverse events during delivery in the labetalol group was 6.52% (3/46), compared with 26.09% (12/46) in the magnesium sulfate group. This is consistent with the results of this study. Both this and Chen's studies indicate that labetalol + magnesium sulfate treatment can effectively improve pregnancy outcomes in HIP patients and reduce adverse pregnancy outcomes.

In conclusion, the combined treatment of magnesium sulfate + labetalol in patients with HIP can reduce diastolic and systolic blood pressure levels, decrease the total adverse reaction rate, reduce adverse pregnancy outcomes, and minimize the total adverse fetal outcome rate. This is worthy of widespread application.

## Disclosure statement

The author declares no conflict of interest.

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