Effect of the drug combination of magnesium sulfate and phentolamine on homocysteine and C-reactive protein in the serum of patients with pregnancy-induced hypertension syndrome

LI MA[1], LIANG LI[2], PING HAN[3], FANCHUN MENG[4], CHUNHONG JIAO[5] and HONGMEI ZHANG[6]

[1]Department of Obstetrics, Jining No. 1 People's Hospital, Jining, Shandong 272011; [2]Department of Pharmacy, Yidu Central Hospital of Weifang, Weifang, Shandong 262500; Departments of [3]Respiratory Medicine, [4]Obstetric Delivery Room and [5]Rehabilitation, The People's Hospital of Zhangqiu Area, Jinan, Shandong 250200; [6]Ward 1, Department of Gynecology, Jining No. 1 People's Hospital, Jining, Shandong 272011, P.R. China

Received November 8, 2018; Accepted February 22, 2019

DOI: 10.3892/etm.2019.7385

Abstract. Effect and clinical efficacy of magnesium sulfate combined with phentolamine on homocysteine and C-reactive protein in the serum of patients with pregnancy-induced hypertension syndrome were investigated. A total of 96 patients with pregnancy-induced hypertension syndrome who were diagnosed and treated in Jining No. 1 People's Hospital from February 2016 to January 2018 were retrospectively analyzed. The patients were grouped according to the dosage regimen. The patients who received the combination treatment of magnesium sulfate and phentolamine on the basis of magnesium sulfate were included in the observation group, and the patients who were treated with the intravenous infusion of magnesium sulfate alone were included in the control group. Mean arterial pressure (MAP), the content of 24 h urine protein, systolic blood pressure (SBP), diastolic blood pressure (DBP), Hcy, and CRP of the pregnant women were observed. MAP and the content of 24 h urine protein, SBP and DBP of the patients in the observation group after the treatment were significantly lower than those of the patients in the control group ($P<0.001$). Hcy and CRP of the patients in the observation group after the treatment were significantly lower than those of the patients in the control group ($P<0.001$). The total effective rate of the patients in the observation group was significantly higher than that of the patients in the control group ($P<0.05$). In conclusion, the meliorative effect of magnesium sulphate combined with phentolamine on the level of MAP, the content of 24 h urine protein, SBP, DBP, Hcy and CRP in pregnant woman had a greater impact than that of the single use of the intravenous infusion of magnesium sulfate in the treatment of pregnancy-induced hypertension syndrome, and the clinical efficacy of magnesium sulphate combined with phentolamine was better, thus worthwhile to promote widely in clinic.

Correspondence to: Dr Hongmei Zhang, Ward 1, Department of Gynecology, Jining No. 1 People's Hospital, 6 Jiankang Road, Jining, Shandong 272011, P.R. China
E-mail: emb5re@163.com

Key words: magnesium sulfate, phentolamine, pregnancy-induced hypertension syndrome, homocysteine, C-reactive protein

Introduction

Pregnancy-induced hypertension syndrome is one of the common clinical gestational complications, it appears after 20 weeks of pregnancy, and the morbidity is high (1). Pregnancy-induced hypertension syndrome is a major threat to maternal and child health (2). Patient with serious conditions will die due to the massive haemorrhage appearing in enterocoelia (3). As the pathogenesis of pregnancy-induced hypertension syndrome is complex, its specific pathogenesis is still unclear in clinic, thus the treatment is difficult (4). Studies have pointed out that currently the preferred drug for the prevention and treatment of pregnancy-induced hypertension syndrome is magnesium sulfate (5).

Magnesium sulfate is an anticonvulsant drug, it inhibits vascular and neural muscles in patients with pregnancy-induced hypertension syndrome by central inhibition and indirectly reduces the blood pressure of patients by dilating blood vessels (6). Although magnesium sulfate has a good clinical effect on the treatment of pregnancy-induced hypertension syndrome, related studies have demonstrated that its marked effect is relatively slow, the dose of magnesium sulfate for the treatment of pregnancy-induced hypertension syndrome is similar to the concentration of poisoning, which facilitates the occurrence of hypermagnesemia, the therapeutic dose has a great influence on the drug concentration in patients' blood (5,7). Phentolamine is a blocker that is widely used to treat peripheral vascular diseases (8). It can also increase the contractility of the myocardium and effectively reduce the related resistance of peripheral blood vessels by blocking

norepinephrine, as a result, the blood vessels are effectively relaxed (9). This study investigated the effect of the drug combination of magnesium sulfate and phentolamine on Hcy and CRP in the serum of patients with pregnancy-induced hypertension syndrome.

Patients and methods

General data. A total of 96 patients with pregnancy-induced hypertension syndrome who were diagnosed and treated in Jining No. 1 People's Hospital (Jining, China) from February 2016 to January 2018 were retrospectively analyzed. The patients were grouped according to the dosage regimen. A total of 48 patients who received the combination treatment of magnesium sulfate and phentolamine on the basis of magnesium sulfate were included in the observation group, and 48 patients who were treated with the intravenous infusion of magnesium sulfate alone were included in the control group. The age range of the observation group was from 21 to 38 years, and the average age was 27.45±11.09 years. The age range of the control group was from 22 to 36 years, and the average age was 27.13±11.58 years. Inclusion criteria: i) Patients who were included conformed to the diagnostic criteria of moderate and severe gestational hypertension. Exclusion criteria: i) Patients who were intolerant or allergic to magnesium sulfate or phentolamine; ii) patients who had mental illnesses and serious medical diseases; and iii) pregnant women who had multiplets. Patients and their families were informed in advance of the study and they signed an informed consent form.

This study was approved by the Ethics Committee of Jining No. 1 People's Hospital. Patients who participated in this research had complete clinical data. The signed informed consents were obtained from the patients or the guardians. The differences in general data, age, sex, body mass index and the condition of obesity between the two groups were not significant (P>0.05), and were comparable (Table I).

Methods. Patients in the control group were given an intravenous infusion of 25 ml of magnesium sulfate (H20033861; Hebei Tiancheng Pharmaceutical Co., Ltd., Guoyao Zhunzi, Hebei, China) and 100 ml of glucose solution with a concentration of 5% (H41022731; Xinxiang Jiushi Pingan Injection Co., Ltd. Guoyao Zhunzi, Xinxiang, China), the infusion was finished in 30 min. The patients were then given an intravenous infusion of 60 ml of magnesium sulfate with a concentration of 25%. Finally, the patients were intravenously instilled with 10 ml of magnesium sulfate. The patients in the observation group were treated with phentolamine on the basis of the single use of the intravenous infusion of magnesium sulfate, and 20 mg of phentolamine (H31020589; Shanghai Xudong Haipu Pharmaceutical Co., Ltd. (domestic), Guoyao Zhunzi, Shanghai, China) was added to the glucose solution with a concentration of 5%, and the patients were intravenously instilled with this mixed solution. During the treatment, the changes of the patients' vital signs were constantly monitored, and the dose was appropriately adjusted according to the changing condition of their vital signs.

Observation indicators and the evaluation criteria of clinical efficacy. Fasting venous blood (5 ml) of the pregnant women in the two groups was collected after fasting for 8 h in 3 days before and after the treatment, the serum was centrifuged at 3,000 x g for 15 min at 4˚C, and the changes of systolic blood pressure (SBP) and diastolic blood pressure (DBP) of the patients in the two groups before and after the treatment were observed. Serum Hcy (enzymatic method was used to detect serum Hcy, normal value was less than 10 μmol/l) and CRP (immunoprecipitation and immunoturbidimetry were used, normal reference value was less than 8 mg/l) of the patients in the two groups were observed before and after the treatment. The mean arterial pressure (MAP) and the content of 24 h urine protein of the patients in the two groups were observed in 3 days before and after the treatment. The clinical efficacy of the patients in the two groups after the treatment was compared. The evaluation criteria of clinical efficacy: i) Effective: The falling range of DBP was <10 mmHg when DBP after the treatment was compared with that before the treatment, DBP decreased to the normal level; or the falling range of DBP was from 10 to 20 mmHg when DBP after the treatment was compared with that before the treatment; or the falling range of SBP was >30 mmHg; ii) markedly effective: The falling range of DBP after the treatment was >20 mmHg, DBP basically returned to the normal level; and iii) ineffective: The changes of DBP and SBP of the patients did not meet the criteria of 'effective' or 'markedly effective' after the treatment (10). Total effective rate = (markedly effective + effective)/the total number of cases.

Statistical analysis. SPSS 17.0 (SPSS, Inc., Chicago, IL, USA) software system was used to carry out the statistical analysis. The enumeration data were expressed in the form of [n (%)], the measurement data were expressed as the mean ± standard deviation, χ^2 test was used in the comparison between the two groups, t-test was used in the comparison of the data between the two groups, the paired t-test was used in the comparison of the data between the groups before and after the treatment. P<0.05 was considered to indicate a statistically significant difference.

Results

Changes of MAP and the content of 24 h urine protein in the patients in observation and control groups and comparison of the content of MAP in patients in two groups before and after treatment. The content of MAP in the patients in the observation group before and after the treatment was 183.24±27.06 and 139.69±15.76 mmHg, respectively, the content of MAP in the patients in the control group before and after the treatment was 184.03±26.54 and 155.02±16.88 mmHg, respectively. MAP after the treatment was significantly lower, and the differences were statistically significant (P<0.001). The differences of MAP in the two groups before treatment were not statistically significant (P>0.05). After the treatment, MAP of patients in the observation group was significantly lower than that in the control group, the differences were statistically significant (P<0.001; Table II).

Changes of the content of 24 h urine protein in patients in two groups before and after treatment. The content of 24 h urine protein in patients in observation group before and

Table I. The general clinical baseline data of the study and the experiment groups [n (%)]/(mean ± standard deviation).

Group	Study group (n=48)	Control group (n=48)	t	P-value
Age (year)	27.45±11.09	27.13±11.58	0.138	0.890
BMI (kg/m^2)	18.46±3.37	19.03±2.82	0.899	0.371
Blood routine				
Hb (gm/dl)	11.45±1.74	11.68±2.45	0.530	0.597
RBC (x10^{12}/l)	4.24±0.36	4.20±0.45	0.481	0.632
PLT (x10^9/l)	146.59±22.40	150.43±24.34	0.804	0.423
Liver function				
ALT (U/l)	22.53±10.52	20.49±8.63	1.039	0.302
AST (U/l)	19.62±8.75	17.48±7.52	1.285	0.202
Renal function				
TP (g/l)	126.36±16.46	79.37±12.50	15.750	<0.001
UREA (mmoI/l)	8.16±1.43	4.47±1.89	10.790	<0.001
CRE (μmoI/l)	177.33±30.72	101.25±20.37	14.300	<0.001
UA (μmoI/l)	602.55±41.26	386.70±47.20	23.850	<0.001

Table II. The comparison of the content of MAP (mmHg) in the patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before treatment	183.24±27.06	184.03±26.54	0.144	0.886
After treatment	139.69±15.76	155.02±16.88	4.599	<0.001
t	9.635	6.390		
P-value	<0.001	<0.001		

MAP, mean arterial pressure.

Table III. The changes of the content of 24 h urine protein in the patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before treatment	2.35±0.36	2.40±0.31	0.729	0.468
After treatment	0.67±0.15	0.93±0.17	7.945	<0.001
t	29.840	28.810		
P-value	<0.001	<0.001		

after treatment was 2.35±0.36 and 0.67±0.15 g, respectively. The content of 24 h urine protein in patients in control group before and after treatment was 2.40±0.31 g and 0.93±0.17 g, respectively. Comparing the content of 24 h urine protein of patients in two groups after treatment with that before treatment, the content of 24 h urine protein after treatment was significantly lower, and the differences were statistically significant (P<0.001). The differences of the content of 24 h urine protein in the two groups before treatment were not statistically significant (P>0.05). After treatment, the content of 24 h urine protein in patients in observation group was significantly lower than that of patients in control group, the differences were statistically significant (P<0.001; Table III).

Changes of SBP and DBP in the patients in the observation and the control groups before and after treatment. The content of SBP of patients in observation group before and after the treatment was 155.76±4.58 and 118.66±3.04mmHg, respectively. Content of SBP in patients in the control group before and after treatment was 155.01±5.67 and 133.71±3.5 mmHg, respectively. Comparing SBP of patients in the two groups after the treatment with that before the treatment, SBP after the treatment was significantly lower, and differences were statistically significant (P<0.001). When two groups were compared with each other, the differences of SBP before the treatment were not statistically significant (P>0.05). After the treatment, SBP of patients in the observation group was significantly lower than that of patients in the control

Table IV. Changes of SBP (mmHg) in patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before treatment	155.76±4.58	155.01±5.67	0.713	0.478
After treatment	118.66±3.04	133.71±3.53	22.389	<0.001
t	46.760	22.090		
P-value	<0.001	<0.001		

SBP, systolic blood pressure.

Table V. Comparison of DBP (mmHg) in patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before treatment	90.63±4.28	91.02±4.31	0.445	0.658
After treatment	75.80±3.11	85.26±4.09	12.760	<0.001
t	19.420	6.716		
P-value	<0.001	<0.001		

DBP, diastolic blood pressure.

group, the differences were statistically significant (P<0.001; Table IV).

Changes of DBP in the patients in the two groups before and after treatment. The content of DBP in patients in the observation group before and after treatment was 90.63±4.28 and 75.80±3.11 mmHg, respectively. The content of DBP in patients in the control group before and after treatment was 91.02±4.31 and 85.26±4.09 mmHg, respectively. DBP after the treatment was significantly lower, and differences were statistically significant (P<0.001). Differences of DBP in the two groups before treatment were not statistically significant (P>0.05). After treatment, DBP of patients in observation group was significantly lower than that of patients in control group and differences were statistically significant (P<0.001; Table V).

Changes of the level of Hcy and CRP in patients in observation and control groups and comparison of level of Hcy in patients before and after treatment. Level of Hcy in patients in observation group before and after treatment was 17.01±2.34 and 5.7 ±1.24 μmol/l, respectively. Level of Hcy in patients in control group before and after treatment was 16.89±2.97 and 8.02±1. 56 μmol/l, respectively. Hcy after treatment was significantly lower, and differences were statistically significant (P<0.001). Differences of Hcy in the two groups before treatment were not statistically significant (P>0.05). After treatment, Hcy of patients in observation group was significantly lower than that of patients in control group and differences were statistically significant (P<0.001; Table VI and Fig. 1).

Comparison of level of CRP in patients in two groups before and after treatment. Level of CRP in patients in observation group before and after treatment was 9.65±2.49 and 4.01±0.35 mg/l, respectively. Level of CRP in patients in control group before and after treatment was 9.23±2.01 and 6.12±1.05 mg/l, respectively. Level of CRP after treatment was significantly lower, and the differences were statistically significant (P<0.001). Differences of level of CRP in the two groups before treatment were not statistically significant (P>0.05). After treatment, level of CRP in patients in observation group was significantly lower than that of patients in control group and differences were statistically significant (P<0.001; Table VII and Fig. 2).

Comparison of the therapeutic efficacy of the patients in the observation and the control groups. The number of the total effective population in the observation group and the control groups was 44 and 34, respectively. The total effective rate of the patients in the observation group was significantly higher than that of the patients in the control group, the differences were statistically significant (P<0.05; Table VIII).

Discussion

Pregnancy-induced hypertension syndrome is a disease that is mainly prevented and controlled by obstetrics and gynecology department, it is one of the major causes of death of pregnant women in gestation period (11). Due to the characteristics of pregnancy-induced hypertension syndrome, such as the rapidly-developing conditions and many complications (12), once patients' condition is not properly controlled pregnancy-induced hypertension syndrome is unceasingly aggravated, this will seriously threaten the life and safety of patients (13). A large number of clinical studies have shown that apart from the changes of indicators of blood pressure levels such as SBP and DBP, the levels of Hcy, CRP, MAP and 24 h urine protein in the peripheral blood serum of patients are closely related to the development of patients' condition

Table VI. Comparison of the level of Hcy (μmol/l) in the patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before the treatment	17.01±2.34	16.89±2.97	0.220	0.826
After the treatment	5.73±1.24	8.02±1.56	7.962	<0.001
t	29.510	18.320		
P-value	<0.001	<0.001		

Table VII. Comparison of the level of CRP (mg/l) in the patients in the two groups before and after the treatment.

Groups	Observation group (n=48)	Control group (n=48)	t	P-value
Before the treatment	9.65±2.49	9.23±2.01	0.909	0.366
After the treatment	4.01±0.35	6.12±1.05	13.210	<0.001
t	15.540	9.501		
P-value	<0.001	<0.001		

Table VIII. Comparison of the therapeutic efficacy of the patients in the two groups.

Groups	n	Markedly effective	Effective	Ineffective	The total effective rate
Observation	48	28 (58.33)	16 (33.33)	4 (8.33)	44 (91.67)
Control	48	20 (41.67)	14 (29.17)	14 (29.17)	34 (70.83)
χ^2		-	-	-	6.838
P-value		-	-	-	0.009

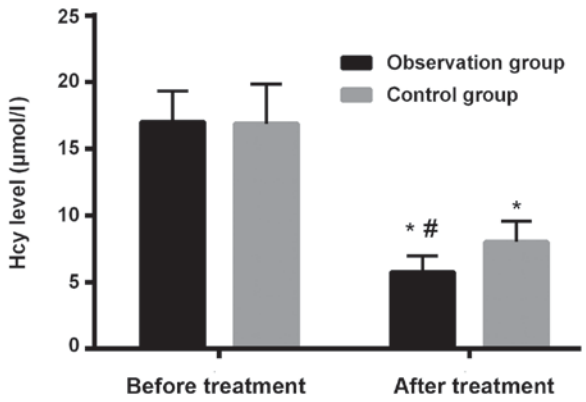

Figure 1. Comparison of the level of Hcy in patients in the two groups before and after treatment. Hcy after treatment is significantly lower, and the differences are statistically significant (*P<0.001). Differences of Hcy in the two groups before treatment are not statistically significant (P>0.05). After treatment, Hcy of patients in observation group is significantly lower than that of patients in control group, and the difference is statistically significant (#P<0.001).

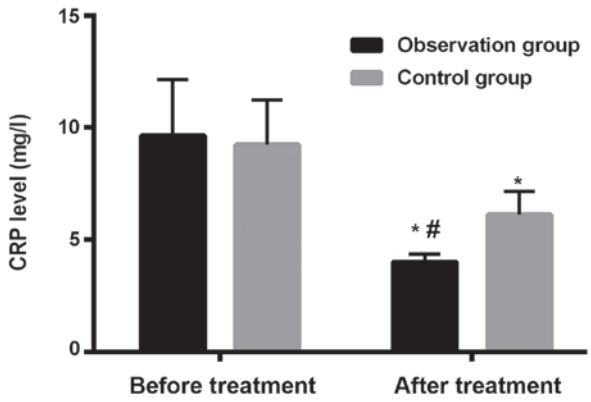

Figure 2. Comparison of the level of CRP in patients in the two groups before and after treatment. CRP after treatment is significantly lower, and differences are statistically significant (*P<0.001). Differences of CRP in the two groups before treatment are not statistically significant (P>0.05). After treatment, CRP of patients in observation group is significantly lower than that of patients in control group, the differences are statistically significant (#P<0.001).

(14-16). Studies have confirmed that CRP is a sensitive indicator of inflammation and it can indicate inflammatory responses in the body (17). In recent years, many clinical studies have demonstrated that the increase of the level of Hcy and CRP may be a risk factor that leads to the occurrence of hypertension during pregnancy (17). When the expression of Hcy in the serum of pregnant women is high, it will destroy the vascular endothelial cells, lead to vasospasm and thus result in pregnancy-induced hypertension syndrome (18). However, there are few studies on the specific effects of the changes of the level of Hcy and CRP on the condition of patients with pregnancy-induced hypertension syndrome. The relationship between the changes of the level of Hcy and CRP and the clinical efficacy of related patients is still unclear. Therefore,

this study investigated the effect of the combination use of magnesium sulfate and phentolamine on Hcy and CRP in the serum of patients with pregnancy-induced hypertension syndrome.

In this study, we first analyzed the changes of MAP and the content of 24 h urine protein in the patients in the observation and the control groups. We found that MAP and the content of 24 h urine protein of patients in the two groups after the treatment were significantly lower than those before the treatment. After the treatment, MAP and the content of 24 h urine protein of patients in the observation group were significantly lower than those of patients in the control group, the differences were statistically significant. A large number of clinical studies have shown that MAP and the content of 24 h urine protein are common monitoring indicators for patients with pregnancy-induced hypertension syndrome, the obvious increase of the two monitoring indicators is closely related to the development of the condition of pregnancy-induced hypertension syndrome (19). Studies related to pregnancy-induced hypertension syndrome have confirmed that the abnormal increase of MAP and the content of 24 h urine protein may aggravate the condition of patients with pregnancy-induced hypertension syndrome (20). Therefore, we believed that the combination use of magnesium sulfate and phentolamine has a better effect on the regulation of MAP and the content of 24 h urine protein in patients with pregnancy-induced hypertension syndrome. Next, we compared the changes in SBP and DBP in the patients between the observation and the control group, we found that SBP and DBP in the patients in the two groups after the treatment were significantly lower than those of patients in the two groups before the treatment. SBP and DBP in the patients in the observation group after the treatment were significantly lower than those of patients in the control group after the treatment, and the differences were statistically significant. Therefore, we believed that the combination use of magnesium sulfate and phentolamine was more effective in the down-regulation of the blood pressure level in patients with pregnancy-induced hypertension syndrome. In a previous study on the effect of magnesium sulfate combined with other drugs and the effect of the single use of magnesium sulfate on the clinical efficacy of patients with pregnancy-induced hypertension syndrome, Nzelu *et al* (21) found that magnesium sulfate combined with phentolamine had a better effect on the blood pressure in pregnant women in the treatment of patients with pregnancy-induc ed hypertension syndrome, which is similar to the results of our study. Then, we monitored the changes of the level of Hcy and CRP in the patients in the observation group and the control group, and found that Hcy of patients in the two groups after the treatment was significantly lower than that before the treatment, thereinto, Hcy in the patients in the observation group after the treatment was significantly lower than that of patients in the control group after the treatment, and the differences were statistically significant. Vitamin B12 is an important cofactor for the metabolism of Hcy. For those pregnant women in the middle and advanced gestation period, the amount of vitamin B12 synthesized in the body is affected by metabolism and the amount of synthesis is reduced, thus this causes the accumulation of Hcy in the body and results in the imbalance of vasomotor factors, eventually pregnancy-induced hypertension syndrome appears in pregnant women (22). CRP is an important indicator of the occurrence of inflammation, the changes of the level of CRP in the serum are closely related to the vascular endothelial injury in the body, the severity of diseases and the prognosis (23). Therefore, we speculated that the reduction range of the level of Hcy and CRP in patients with pregnancy-induced hypertension syndrome, who are treated with magnesium sulfate combined with phentolamine, is higher than that of the single use of intravenous infusion treatment of magnesium sulfate, and the clinical improvement effect is better. Finally, we compared the clinical efficacy of the patients in the two groups after the treatment, we found that the total effective rate of magnesium sulfate combined with phentolamine in the treatment of the patients with pregnancy-induced hypertension syndrome was significantly higher than that of the patients who were treated with the intravenous infusion of magnesium sulfate alone. A large number of studies on the treatment of pregnancy-induced hypertension syndrome, have verified that the efficacy of magnesium sulfate combined with phentolamine is better than that of the single use of magnesium sulfate in the treatment of patients with pregnancy-induced hypertension syndrome (24).

In this study, there are still some shortcomings, for example, the study data can only indicate the improvement of the condition of the patients with pregnancy-induced hypertension syndrome within 3 days after the treatment, the results of the later stage still need to be clarified. This may have some impact on the results of the study; therefore, we will follow up the patients from time to time according to the relevant data of the patients in the later stage.

In summary, the meliorative effect of magnesium sulphate combined with phentolamine on the level of MAP, the content of 24 h urine protein, SBP, DBP, Hcy and CRP in pregnant woman is far more impactful than that of the single use of the intravenous infusion of magnesium sulfate in the treatment of pregnancy-induced hypertension syndrome, and the clinical efficacy of magnesium sulphate combined with phentolamine is better, thus, it is worthwhile to promote it widely in clinic.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Authors' contributions

LM wrote the manuscript. LM and LL recorded and analyzed observation indicators. CJ and HZ were responsible for the general data of patients. FM and PH contributed to evaluation of clinical efficacy. The final version was read and adopted by all the authors.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Jining No. 1 People's Hospital (Jining, China). Patients who participated in this research had complete clinical data. The signed informed consents were obtained from the patients or the guardians.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Zhou A, Xiong C, Hu R, Zhang Y, Bassig BA, Triche E, Yang S, Qiu L, Zhang Y, Yao C, *et al*: Pre-pregnancy BMI, gestational weight gain, and the risk of hypertensive disorders of pregnancy: a cohort study in Wuhan, China. PLoS One 10: e0136291, 2015.
2. Zeng L, Yang K and Ge J: Uncovering the pharmacological mechanism of astragalus salvia compound on pregnancy-induced hypertension syndrome by a network pharmacology approach. Sci Rep 7: 16849, 2017.
3. Ankichetty SP, Chin KJ, Chan VW, Sahajanandan R, Tan H, Grewal A and Perlas A: Regional anesthesia in patients with pregnancy induced hypertension. J Anaesthesiol Clin Pharmacol 29: 435-444, 2013.
4. Sato T and Takeuchi M: Pregnancy-induced hypertension-related chorioretinitis resembling uveal effusion syndrome: a case report. Medicine (Baltimore) 97: e11572, 2018.
5. Jia JP, Wu YX and Xie GH: Clinical observation on treatment of albuminuria in patients with pregnancy-induced hypertension syndrome in puerperium by Xiaobai Decoction. Zhongguo Zhong Xi Yi Jie He Za Zhi 27: 644-646, 2007 (In Chinese).
6. Fang MR and Li JC: Evaluation of the efficacy of ligustrazine collaborated with magnesium sulfate in the treatment of pregnancy-induced hypertension in rats. Shi Yan Sheng Wu Xue Bao 38: 45-53, 2005 (In Chinese).
7. Wang L, Liu ZQ, Huo YQ, Yao LJ, Wei XG and Wang YF: Change of hs-CRP, sVCAM-1, NT-proBNP levels in patients with pregnancy-induced hypertension after therapy with magnesium sulfate and nifedipine. Asian Pac J Trop Med 6: 897-901, 2013.
8. Pan L, Liu C, Kong Y, Piao Z and Cheng B: Phentolamine inhibits angiogenesis in vitro: suppression of proliferation migration and differentiation of human endothelial cells. Clin Hemorheol Microcirc 65: 31-41, 2017.
9. Burton TJ and Wilkinson IB: The dangers of immediate-release nifedipine in the emergency treatment of hypertension. J Hum Hypertens 22: 301-302, 2008.
10. Folic MM, Jankovic SM, Varjacic MR and Folic MD: Effects of methyldopa and nifedipine on uteroplacental and fetal hemodynamics in gestational hypertension. Hypertens Pregnancy 31: 31-39, 2012.
11. Lungeanu-Juravle L, Patrascu N, Deleanu OC and Cinteza M: The role of obstructive sleep apnea in developing gestational hypertension and preeclampsia. Maedica (Buchar) 11: 330-333, 2016.
12. Uguz F: Is there any association between use of antidepressants and preeclampsia or gestational hypertension?: a systematic review of current studies. J Clin Psychopharmacol 37: 72-77, 2017.
13. Tsai HM and Kuo E: From gestational hypertension and preeclampsia to atypical hemolytic uremic syndrome. Obstet Gynecol 127: 907-910, 2016.
14. Tinsley JH, Chiasson VL, South S, Mahajan A and Mitchell BM: Immunosuppression improves blood pressure and endothelial function in a rat model of pregnancy-induced hypertension. Am J Hypertens 22: 1107-1114, 2009.
15. Tuuri AL, Jauhiainen MS, Tikkanen MJ and Kaaja RJ: Systolic blood pressure and fatty acid-binding protein 4 predict pregnancy-induced hypertension in overweight nulliparous women. Placenta 35: 797-801, 2014.
16. van Middendorp D, ten Asbroek A, Bio FY, Edusei A, Meijjer L, Newton S and Agyemang C: Rural and urban differences in blood pressure and pregnancy-induced hypertension among pregnant women in Ghana. Global Health 9: 59, 2013.
17. Pan A, Wang Y, Yuan JM and Koh WP: High-sensitive C-reactive protein and risk of incident type 2 diabetes: A case-control study nested within the Singapore Chinese Health Study. BMC Endocr Disord 17: 8, 2017.
18. Li S, Tang X, Peng L, Luo Y, Zhao Y, Chen L, Dong R, Zhu J, Chen Y and Liu J: A head-to-head comparison of homocysteine and cystatin C as pre-procedure predictors for contrast-induced nephropathy in patients undergoing coronary computed tomography angiography. Clin Chim Acta 444: 86-91, 2015.
19. Liu F, Yang H, Li G, Zou K and Chen Y: Effect of a small dose of aspirin on quantitative test of 24-h urinary protein in patients with hypertension in pregnancy. Exp Ther Med 13: 37-40, 2017.
20. Gangaram R, Ojwang PJ, Moodley J and Maharaj D: The accuracy of urine dipsticks as a screening test for proteinuria in hypertensive disorders of pregnancy. Hypertens Pregnancy 24: 117-123, 2005.
21. Nzelu D, Yeung F, Couderq D, Shennan A and Kametas NA: An inaccurate automated device negatively impacts the diagnosis and treatment of gestational hypertension. Pregnancy Hypertens 10: 28-33, 2017.
22. Shekelle P: Lowering homocysteine with folic acid and B vitamins did not prevent vascular events after myocardial infarction. Evid Based Med 11: 105, 2006.
23. Mitaki S, Nagai A, Oguro H and Yamaguchi S: C-reactive protein levels are associated with cerebral small vessel-related lesions. Acta Neurol Scand 133: 68-74, 2016.
24. Bánhidy F, Acs N, Puhó EH and Czeizel AE: The efficacy of antihypertensive treatment in pregnant women with chronic and gestational hypertension: a population-based study. Hypertens Res 33: 460-466, 2010.