Correlation of gestational hypertension with abnormal lipid metabolism, insulin resistance and D-dimer and their clinical significance

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Abstract. Correlation of gestational hypertension with abnormal lipid metabolism, insulin resistance and D-dimer were investigated. Seventy-three patients with gestational hypertension in Jinhua People's Hospital were selected as the observation group and 70 healthy gestational subjects were selected as the control group. The indexes of lipid metabolism, insulin resistance index [homeostasis model assessment (HOMA)] and the level of D-dimer in the two groups were compared and the correlation of gestational hypertension with the changes in lipid metabolism, insulin resistance and D-dimer was analyzed. The level of HDL-C (high-density lipoprotein cholesterol) in the observation group was significantly lower than that in the control group (P<0.05), while the levels of other indexes were all significantly higher than those in the control group (P<0.05). HOMA index and D-dimer in the observation group were both significantly higher than those in the control group (P<0.05). TG was positively correlated with gestational hypertension (r=0.8767, P<0.01). The correlation analysis of HOMA and gestational hypertension showed positive correlation (r=0.8819, P<0.01). In addition, D-dimer was positively correlated with gestational hypertension (r=0.8933, P<0.01). Lipid metabolism indexes are abnormal in patients with gestational hypertension as well as for insulin resistance index and D-dimer. Besides, the above-mentioned indexes are all correlated with the patients with gestational hypertension. Therefore, more observations should be made on lipid metabolism indexes, insulin resistance and D-dimer in the future treatment of gestational hypertension.

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Introduction

Gestational hypertension is an obstetrical and gynecological disease with a high morbidity rate, and its onset often brings serious consequences to patients, such as eclampsia, dyspnea and abortion. If timely diagnosis and treatment are not received, it can even be life-threatening (1,2). As the mechanism has been far from explicated, there are still many difficulties in treatment (3,4). It is found clinically that the onset of gestational hypertension has a good correlation with vascular endothelial injury, the latter of which is also closely related to hyperlipidemia, suggesting that there is a correlation between abnormal lipid metabolism and gestational hypertension (5-7).

Metabolic diseases are usually manifested as abnormal insulin resistance, and gestational hypertension is also a kind of metabolic disease, thus there are possibly a number of changes in its insulin resistance (8). Blood coagulation and fibrinolysis are common manifestations in patients with gestational hypertension and such physical changes have a great relation with D-dimer, which can be used to deduce the function of D-dimer in gestational hypertension. Therefore, the treatment and prevention of gestational hypertension can be achieved by controlling the D-dimer (9). A total of 73 patients with gestational hypertension and 70 healthy subjects were selected into the study, and the abnormal lipid metabolism, insulin resistance and D-dimer in the two groups were compared. The correlations of gestational hypertension with the above-mentioned indexes were analyzed in order to provide more therapeutic targets for gestational hypertension.

Patients and methods

General data. A total of 73 patients with gestational hypertension in Jinhua People's Hospital (Jinhua, China) from December 2016 to December 2017 were selected and divided into the observation and control groups. Patients in the observation group (aged 27.3±2.6 years, gestational weeks 35.3±3.4 weeks, pre-pregnant body mass index BMI 22.34±2.8 kg/m²) and the subjects in the control group (aged 28.9±2.8 years, gestational weeks 34.5±3.3 weeks, pre-pregnant BMI 23.09±2.4 kg/m²) were primiparae. Inclusion criteria: patients with gestational hypertension conforming to

Table I. Comparison of general data between two groups (mean ± SD).

Groups	n	Age (years)	Gestational weeks (weeks)	Pre-pregnant BMI (kg/m²)	History of gestation
Observation group	73	27.3±2.6	35.3±3.4	22.34±2.8	Primiparae
Control group	70	28.9±2.8[a]	34.5±3.3[a]	23.09±2.4[a]	Primiparae

[a]P<0.05 compared with the observation group.

Table II. Comparison of lipid metabolism indexes between two groups (mean ± SD).

Indexes	Observation group	Control group
TG (mmol/l)	3.23±0.32	2.43±0.21[a]
TC (mmol/l)	5.85±0.52	5.33±0.55[a]
HDL-C (mmol/l)	1.80±0.12	2.09±0.21[a]
LDL-C (mmol/l)	3.21±0.31	2.32±0.21[a]

[a]P<0.05 compared with the observation group.

Figure 1. Comparison of insulin resistance between the two groups. *P<0.05.

the diagnostic criteria of gestational hypertension specified in the 8th edition of Obstetrics and Gynaecology and patients without serious injury in the heart, liver and kidney. Exclusion criteria: patients with poor compliance and unable to cooperate with the diagnosis of doctors, patients with other metabolic diseases affecting insulin resistance, or patients with lipid metabolic disease.

The study was approved by the Ethics Committee of Jinhua People's Hospital and informed consents were signed by the patients or guardians.

Classification of gestational hypertension. Based on the classification methods in the 8th edition of Obstetrics and Gynaecology, gestational hypertension was divided into three grades (mild, moderate and severe). Mild: patients have no obvious physical discomfort and slight discomfort will disappear naturally after several days. Moderate: patients suffer from hypertension and edema. Severe: patients have various adverse reactions, such as nausea, tachypnea, chest stuffiness, diastolic blood pressure >14.7 kPa and systolic blood pressure >21.3 kPa.

Indexes of lipid metabolism. The levels of triglyceride (TG), total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) were detected with a full-automatic biochemical analyzer. HDL-C was detected via shielded method and other indexes were detected via enzyme assay.

Insulin resistance index. The level of fasting insulin (FINS) was detected with a FINS kit, the level of fasting blood glucose (FBG) was detected via glucose oxidase method. Then HOMA index was calculated using the levels of FINS and FBG.
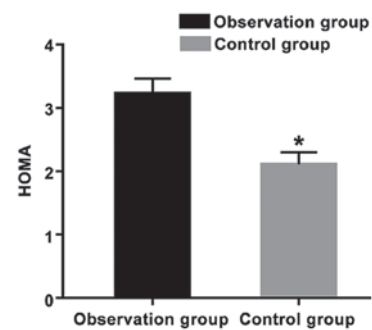
Detection of D-dimer. The fasting venous blood was extracted from the pregnant woman and then the upper-layer serum was taken for centrifugation at 3,000 x g for 5 min. The level of D-dimer in plasma was detected within 2 h via immunoturbidimetry.

Statistical analysis. Statistical Product and Service Solutions (SPSS) 17.0 software (SPSS, Inc., Chicago, IL, USA) was used for data statistics and analysis. t-test was used for the difference comparison between the two groups (measurement data). Chi-square test was used for the difference comparison of enumeration data. Pearson's method was used for correlation analysis. P<0.05 was considered to indicate a statistically significant difference.

Results

Comparison of general data between two groups. Patients in the observation group (aged 27.3±2.6 years, gestational weeks 35.3±3.4 weeks, pre-pregnant BM 22.34±2.8 kg/m²) and the subjects in the control group (aged 28.9±2.8 years, gestational weeks 34.5±3.3 weeks, pre-pregnant BMI 23.09±2.4 kg/m²) were primiparae. There were no significant differences in any of these indexes (Table I).

Comparison of lipid metabolism indexes between two groups. The level of HDL-C in control group was significant higher than that in the observation group, while the levels of other indexes were all lower than those in the observation group (P<0.05), and the differences were statistically significant (Table II).

Comparison of insulin resistance between two groups. HOMA index in the observation group was significantly higher than that in the control group (P<0.05), and the difference was statistically significant (Fig. 1).
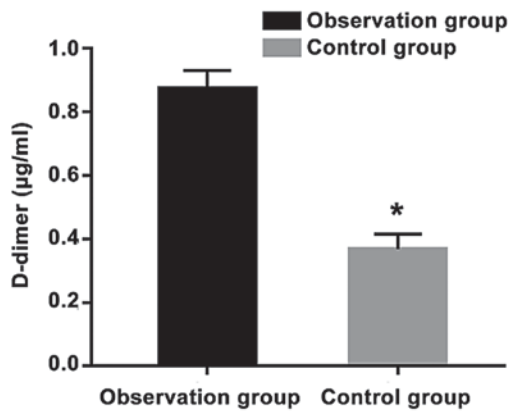
Figure 2. Comparison of D-dimer between the two groups. *P<0.05.

Figure 5. Correlation analysis of D-dimer and the grade of gestational hypertension. 1, mild; 2, moderate; 3, severe,
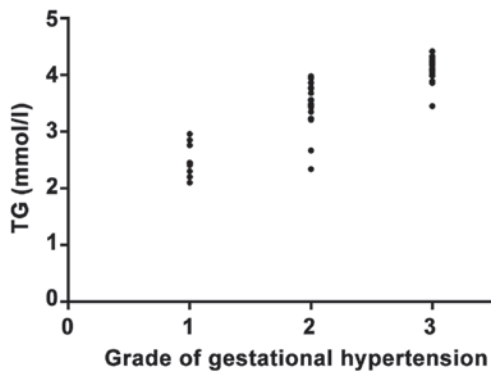

Figure 3. Correlation analysis of TG and the grade of gestational hypertension. 1, mild; 2, moderate; 3, severe.
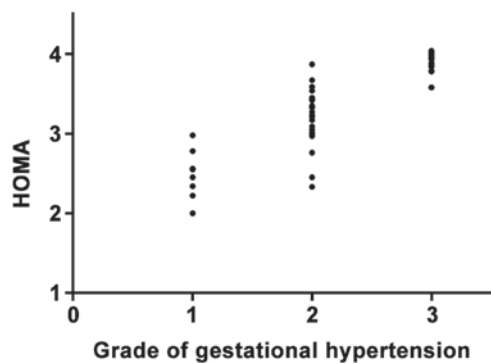

Figure 4. Correlation analysis of HOMA and the grade of gestational hypertension. 1, mild; 2, moderate; 3, severe.

Comparison of D-dimer between two groups. The level of D-dimer in the observation group was significantly higher than that in the control group (P<0.05) (Fig. 2).

Correlation analysis of TG and the grade of gestational hypertension. In the correlation analysis of TG and the grade of gestational hypertension, it was found that TG was positively correlated with gestional hypertension (r=0.8767, P<0.01) (Fig. 3).

Correlation analysis of HOMA and the grade of gestational hypertension. The correlation analysis of HOMA and the grade of gestational hypertension demonstrated that HOMA was positively correlated with gestational hypertension (r=0.8819, P<0.01) (Fig. 4).

Correlation analysis of D-dimer and the grade of gestational hypertension. In the correlation analysis of D-dimer and the grades of gestational hypertension, it was revealed that D-dimer was positively correlated with gestational hypertension (r=0.8933, P<0.01) (Fig. 5).

Discussion

The morbidity rate of gestational hypertension is higher among women during pregnancy, and if timely treatment is not received, severe consequences will be caused, such as placental abruption, shock and even death (10). Though great attention has been put on gestational hypertension in clinic, its mechanism has not been fully investigated. Therefore, there are considerable difficulties in treatment (3,11).

Clinically, gestational hypertension is considered to be correlated with endothelial injury. The more severe the injury is, the higher the morbidity rate of gestational hypertension will be. As abnormal lipid metabolism often leads to vascular endothelial cell damage, it can be considered that there is a correlation between abnormal lipid metabolism and gestational hypertension (12,13).

In this study, it was found that the level of HDL-C in the observation group was significantly lower than that in the control group (P<0.05), while the levels of other indexes were all significantly higher than those in the control group. Moreover, gestational hypertension was found to be positively correlated with TG, suggesting that the morbidity rate of gestational hypertension will increase with the increased level of TG. Intestinal absorption capacity of pregnant women will increase during pregnancy, especially the absorption of fat, which may lead to the increased levels of TG and TC in pregnant women.

In case of excessive increase, severe endothelial cell damage will be caused, leading to gestational hypertension. Besides, the level of HDL-C in the observation group was found to be significantly lower than that in the control group during the investigation, suggesting that the level of TG is very high in body and its synthetic process is highly active,

thus inhibiting the histolysis function of surrounding tissues. In addition, the level of LDL-C in the observation group was significantly higher than that in the control group. When there is excessive LDL-C, part of LDL-C is converted to oxidized LDL-C, which brings a series of consequences, such as serious injury to endothelial cells, higher cell permeability, more release of endothelin, higher blood pressure and even intravascular coagulation (14,15).

In this study, the HOMA index in the observation group was significant higher than that in the control group (P<0.05) and HOMA was positively correlated with gestational hypertension. Insulin resistance refers to the decrease in the sensibility of tissues and muscles in body to insulin, which results in such symptoms as lower sugar tolerance and abnormal lipid metabolism. In this case, the conversion of glucose to TG is promoted and the level of free fatty acid is increased, thus, causing abnormal lipid metabolism (16,17).

Patients with gestational hypertension usually have symptoms of spasm, blood coagulation and fibrinolysis, which result in thrombus, seriously threatening the health of patients and fetuses. Therefore, the occurrence of blood coagulation should be reduced in treatment. D-dimer is the representative factor of hyperfibrinolysis and its increase indicates that fibrinolysis system activity is abnormal and the fibrinolysis function is reduced (18,19). Moreover, the level of D-dimer in the observation group was found to be significantly lower than that in the control group in the study, and it was increased with the exacerbation of the disease.

In conclusion, patients with gestational hypertension are found to have abnormal lipid metabolism, higher insulin resistance (HOMA) and significant higher D-dimer. Gestational hypertension is positively correlated with TG, HOMA and D-dimer. It is suggested that more attention should be paid to the detection of the above-mentioned indexes in the treatment and prevention of gestational hypertension, and preventive measures should be enhanced once these indexes are found to be abnormal.

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Availability of data and material

All data generated or analyzed during this study are included in this published manuscript. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

YJ wrote the manuscript. YJ and MW recorded and analyzed indexes of lipid metabolism. HX and BY interpreted indexes of lipid metabolism. MZ and YZ helped with insulin resistance index. JW detected D-dimer. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The study was approved by the Ethics Committee of Jinhua People's Hospital (Jinhua, China) and informed consents were signed by the patients or guardians.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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