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Original Article

An analysis of the risk factors of preeclampsia and prediction based on combined biochemical indexes

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Abstract This study aims to investigate the risk factors and the joint biochemical indicators predictive value for preeclampsia. Related factors and biochemical indicators were investigated in 558 patients with preeclampsia and 435 normal pregnant women. Multiplicity analysis was performed by logistic regression. The predictive value of the biochemical index and joint biochemical indicators for predicting the incidence of pregnant women preeclampsia were analyzed by ROC curve. A progestation BMI of >24 kg/m^2 (OR = 5.412, 95% CI: 1.169–9.447), hypertension history (OR = 7.487, 95% CI: 2.541–11.247) and advanced age (>35 years old, OR = 6.321, 95% CI: 3.142–20.342) are risk factors for preeclampsia. Tumor necrosis factor-α and plasma protein-A are valuable for preeclampsia prediction. The predictive success of preeclampsia could be improved by clinical risk factors associated with biochemical indicators detection.

Introduction

Preeclampsia is a vasospasm, the leading cause of death in pregnant women, and the most common cause of premature labor due to iatrogenic treatment. Acompany with the mortality of pregnant women with preeclampsia increasing, the fetal mortality and disability rates rise [1–3]. At present, epidemiologic study have raised more aware of the risk factors for preeclampsia [4–8]. It has been found that early intervention in pregnant women with high risk factors for preeclampsia play an obvious significance in clinical value. However, due to changes in people's lifestyle and the existence of regional and racial differences, there are significant differences in high risk factors and low risk factors for preeclampsia. Studies on most biochemical markers in late pregnancy did not reveal any predictive value for preeclampsia. Few studies have investigated the predictive value of biochemical markers in the peripheral

Conflicts of interest: All authors declare no conflicts of interest.

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blood of pregnant women in early pregnancy, and there is also no study on the predictive value of the combination of clinical factors and laboratory markers for preeclampsia. Therefore, in the present study, the predictive value of the combination of clinical high risk factors and biochemical markers for preeclampsia in pregnant women was investigated.

Methods

General information

A total of 558 pregnant women with preeclampsia who received medical service and delivered in the Obstetric Department of our hospital between June 2015 and June 2016 were enrolled into this study. These patients had a gestational age of within 22—40 weeks, with a mean gestational age of 37.01 ± 3.26 weeks. All patients met the diagnostic criteria for preeclampsia. At the same time, 435 pregnant women who underwent antenatal care during the same time period and were found to have no obstetric complications were enrolled as the control group. All patients provided a signed informed consent before the investigation.

Methods and basic information

The basic data of these pregnant women including age, gender, height, body weight, history of hypertension, hyperlipidemia, diabetes, family history of eclampsia, marital status, smoking history, drinking history, education level, other systemic organ diseases, gravidity, complications, organ function, body temperature, heart rate, respiratory rate, arterial systolic blood pressure, arterial diastolic blood pressure and blood index data, were recorded. Biochemical index detection: Two ml of peripheral blood was withdrawn from each patient at the gestational age of within 10—14 weeks. In the present study, enzyme-linked immunosorbent assay (ELISA) was used to detect the levels of pregnancy-associated plasma protein-A, fetal hemoglobin, placental growth factor, D-dimer, C-reactive protein (CRP), interleukin-6 (IL-6) and tumor necrosis factor-α (TNF-α).

Statistical analysis

Data were statistically analyzed using statistical software SPSS 15.0. Measurement data were expressed as mean ± standard deviation ($\bar{x} \pm SD$), and *t*-test was used to evaluate the characteristics in the clinical data of pregnant women. Furthermore, the risk factors for preeclampsia were analyzed using univariate logistic regression analysis, and the independent risk factors for preeclampsia were analyzed using multivariate logistic regression analysis. The best combination of clinical factors and biochemical indexes were explored using the receiver operating characteristic (ROC) curve, in order to improve the predictive value and optimize the prediction system. $P < 0.05$ was considered statistically significant.

Results

Analysis of clinical risk factors for preeclampsia

These risk factors were analyzed using univariate analysis, and 13 variables were analyzed using multivariate logistic regression analysis. Hence, five high-risk factors related to preeclampsia were revealed, which are listed in the following order according to the odds ratio (OR) values: history of hypertension, advanced age, high blood lipids, body mass index (BMI), and history of diabetes mellitus (Table 1).

Analysis of biochemical indexes using the ROC curves

The predictive value of the plasma levels of pregnancy-related plasma protein-A, growth factor, D-dimer, CRP, IL-6 and TNF-α in pregnant women for preeclampsia were analyzed. These results suggest that TNF-α and plasma protein-A have predictive values for preeclampsia (Table 2).

Analysis of the clinical risk factors for preeclampsia and prediction based on the combination of risk factors and biochemical indexes

The analysis results are shown in Table 3.

Discussion

Preeclampsia is a vasospasm. The incidence of this disease in primipara is approximately 3—8%. In some certain populations, the incidence can be triple increased. The fundamental pathophysiological changes involve systemic arteriolar spasm, loss of function of endothelial cells, and systemic target organ damage as well as different clinical signs due to blood flow decreased [9—11]. Although the etiology and pathogenesis are unclear yet, it is generally

Table 1 Analysis of clinical risk factors for preeclampsia.

	B	S E	Wald	OR	P	94% CI
Advanced age	3.541	0.485	7.146	6.321	0.01	3.142—20.342
History of hypertension	2.432	0.574	14.257	7.487	0.004	2.541—11.247
High blood lipids	3.845	0.624	11.264	5.578	0.033	3.145—26.642
History of diabetes mellitus	1.234	0.454	17.218	4.568	0.039	2.451—15.264
BMI	0.157	0.062	6.414	5.412	0.026	1.169—9.447

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