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Comprehensive Analysis of the Correlation between Estrogen Levels, Homocysteine, and Lipid Profiles in Postmenopausal Women with Coronary Heart Disease

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Abstract: *Objective:* To investigate the correlation between estrogen levels, blood homocysteine, and blood lipids in postmenopausal female patients with coronary heart disease. *Methods:* This study selected 50 postmenopausal female patients with coronary heart disease from Northeast Normal University Hospital (observation group). The data collection period extended from June 2021 to June 2023. Simultaneously, 50 healthy patients with no history of coronary heart disease were selected during the same period as the control group. Physical examinations were conducted for all participants. Estrogen levels, blood homocysteine, and blood lipid levels were tested in both groups. *Results:* Compared to the control group, the observation group exhibited higher levels of follicle-stimulating hormone (FSH), total cholesterol (TC), and homocysteine (Hcy), and lower levels of high-density lipoprotein cholesterol (HDL-C; $P < 0.05$). Pearson correlation analysis revealed a negative correlation between estradiol (E2) levels and changes in Hcy, TC, and low-density lipoprotein cholesterol (LDL-C) levels ($P < 0.01$). Multivariate analysis indicated that E2 serves as a protective factor against coronary heart disease in postmenopausal women. Decreased E2 levels, LDL-C, and Hcy were identified as independent risk factors for coronary heart disease in women ($P < 0.05$). *Conclusion:* A declining trend in estrogen levels among postmenopausal women has implications for their blood lipid levels and is closely associated with the development of chronic complications of menopause.

Keywords: Postmenopausal women; Coronary heart disease; Estrogen levels; Blood homocysteine; Blood lipids

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1. Introduction

For women, estrogen serves as a protective hormone, playing a crucial role in insulin resistance and the regulation of glucose and lipid metabolism. A decline in estrogen levels in a woman's body not only increases the risk of chronic diseases but also contributes to abnormal blood lipid metabolism, with a higher incidence compared to men of the same age [1]. Previous studies have shown a close association between the decline in

estrogen levels and the development of coronary heart disease in postmenopausal female patients [2,3]. The objective of this study is to investigate the correlation between estrogen levels, blood homocysteine, and blood lipids in postmenopausal female patients with coronary heart disease.

2. Materials and methods

2.1. General information

This study focuses on postmenopausal female patients with coronary heart disease and women without coronary heart disease, with the treatment period spanning from June 2021 to June 2023. Each group comprised 50 cases.

Inclusion criteria included patients who provided informed consent, were over 50 years old and had complete clinical data. Exclusion criteria included patients with acute myocardial infarction, patients with an apparent bleeding tendency, and patients with liver and renal insufficiency.

In the observation group (50 cases), the average age was 61.52 ± 2.16 years, ranging from 55 to 68 years. In the control group (50 cases), the average age was 61.59 ± 2.97 years, ranging from 56 to 68 years. No significant difference in age ($P > 0.05$) was observed, allowing for valid comparisons.

2.2. Method

Before blood collection from both groups, subjects were advised to abstain from lipid-lowering and hormone drugs and ensure blood was drawn on an empty stomach. Seven mL of blood was drawn from the median cubital vein early in the morning, divided into two tubes, with 5 mL injected into an ordinary dry tube. Serum was separated within 2 hours and stored at -80°C for detecting follicle-stimulating hormone (FSH), estradiol (E2), and homocysteine (Hcy). The remaining 2 mL was injected into a procoagulant tube for testing blood lipid levels. A fully automatic immunoluminescent analyzer tested sex hormones and Hcy levels, while a fully automatic biochemical analyzer (model: Hitachi 3500) assessed various blood lipid levels. All operations followed the provided instructions.

2.3. Observation indicators

Comparison of blood lipid, homocysteine, and estrogen levels in both groups, along with the analysis of the correlation between serum estradiol levels and other factors.

2.4. Statistical processing

Data obtained from the study were analyzed using SPSS 20.0, with all results conforming to normal distribution. Measurement results were expressed as mean ± standard deviation (SD), and the *t*-test was employed. Counting results were expressed as a percentage (%), using the χ^2 test. A result of $P < 0.05$ indicated statistical significance in comparisons.

3. Result

3.1. Comparison of blood lipids, Hcy, and estrogen levels between the two groups

The levels of FSH, TC, and Hcy in the observation group were higher than those in the control group, while the HDL-C level was lower than that of the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of various indicator levels

Group	*n*	FSH (U/L)	E2 (pg/mL)	TC (mmol/L)	HDL-C (mmol/L)	LDL-C (mmol/L)	Hcy (μmol/L)
Observation group	50	90.36 ± 3.11	45.85 ± 1.52	5.55 ± 1.02	1.42 ± 0.01	2.88 ± 1.52	15.85 ± 1.85
Control group	50	63.25 ± 2.01	57.88 ± 2.79	4.21 ± 1.52	1.58 ± 0.21	2.61 ± 0.41	9.22 ± 1.85
t value	-	51.768	26.774	5.176	5.381	1.213	17.919
P value	-	0.000	0.000	0.000	0.000	0.228	0.000

3.2. Analysis of the correlation between E2 levels and other independent risk factors in postmenopausal women with coronary heart disease

Table 2 shows that the serum E2 levels exhibited a negative correlation with other factors ($P < 0.01$).

Table 2. Analysis of the correlation between serum E2 levels and other factors

Relevant factor	Correlation coefficient	*P*
Hcy	-0.647	< 0.01
TC	-0.558	< 0.01
HDL-C	0.619	< 0.05
LDL-C	-0.751	< 0.01

3.3. Multifactor logistic regression analysis of independent risk factors for coronary heart disease in menopausal women

In this analysis, the dependent variable is coronary heart disease, and the independent variables are serum E2, Hcy, and FSH levels. The results of multifactor regression analysis indicate that the protective factor for coronary heart disease in postmenopausal women is the serum E2 level. Independent risk factors for coronary heart disease in patients include decreased E2 levels, increased LDL-C, and elevated Hcy ($P < 0.05$), as shown in **Table 3**.

Table 3. Multivariate logistic regression analysis

Risk factors	B	SE	Wald	*P*	OR
E2	-0.28	0.09	11.85	< 0.01	0.78
Hcy	0.39	0.13	8.89	< 0.01	1.49
LDL-C	0.17	0.06	9.08	< 0.01	1.18

4. Discussion

Estrogen is ubiquitously present in the female body, primarily synthesized and secreted by the ovaries. Upon entering puberty, the ovaries release an appropriate amount of estrogen, expediting the development of the fallopian tube, vagina, ovary, and uterus. During this phase, the endometrium undergoes varying degrees of hyperplasia, culminating in the initiation of menstruation. When a woman ovulates, luteal cells complete the secretion of progesterone and estrogen, resulting in corresponding changes in the patient's secretory function and fluctuations in the ovarian cycle [4,5].

The secretion of normal ovarian hormones in females is intricately tied to the ovarian cycle. As women

transition into the menopausal stage, not only does their age increase, but their physiological functions also decline, accompanied by a corresponding decrease in ovarian function. Some individuals may develop endocrine disorders during this stage, leading to a decline in estrogen levels and manifesting as various signs of aging in the body. Common manifestations include dry skin, fluctuating moods, feelings of depression and apathy, muscle relaxation, and other physiological changes. Additionally, some patients may experience more severe pathological manifestations such as palpitations, dyslipidemia, osteoporosis, and hypertension [6].

As a disease affecting glucose metabolism, diabetes is influenced by various factors, most of which result from the combined effects of environmental and genetic factors. In postmenopausal women, a common occurrence is the reduction of estrogen levels, which correlates with the onset of diabetes. This condition is closely linked to dyslipidemia and diabetes. Menopause, for women, is a distinctive period characterized by a higher incidence of various chronic complications, dyslipidemia, diabetes, and other diseases compared to men [7].

Blood homocysteine, as a sulfur-containing amino acid, serves as a crucial intermediate product. Under normal conditions, the body can break down and metabolize blood homocysteine, maintaining its levels low. However, when primary and secondary factors affect the body, blood homocysteine metabolism becomes abnormal, resulting in a significant increase in its concentration. This elevation in blood homocysteine poses an increased risk of various diseases, with peripheral vascular and cerebrovascular diseases being the most commonly observed [8].

The findings of this study indicate that in comparison to women without coronary heart disease, menopausal women with coronary heart disease exhibit significantly higher levels of Hcy. This outcome is primarily attributed to the decrease in estrogen levels during menopause, leading to corresponding alterations in Hcy concentration. Given this scenario, it becomes imperative to enhance patient follow-up and closely monitor the potential development of cardiovascular diseases, aiming for timely discovery and treatment.

In the analysis of risk factors for coronary heart disease in postmenopausal women, it was observed that E2, as an independent risk factor, is negatively correlated with LDL-C and Hcy. The reduction in E2 levels and the elevation of LDL-C and Hcy levels contribute to the occurrence of coronary heart disease [9].

In summary, for menopausal women with coronary heart disease, the decline in estrogen levels is associated with dyslipidemia and an increase in blood homocysteine levels. In clinical practice, it is crucial to pay attention to cardiovascular diseases in patients, enabling early detection and prompt intervention.

Disclosure statement

The authors declare no conflict of interest.

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