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In-Depth Analysis of the Clinical Value of Combined Detection of Serum Homocysteine and Uric Acid in Hypertensive Patients

Lin Meng*, Cuijing Shi*, Daiwei Wu, Xiaoyu Jiang#

Department of Clinical Laboratory, The Third People's Hospital of Nanning, Nanning, Guangxi

Correspondence to: Xiaoyu Jiang, 38669739@qq.com
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ABSTRACT

Objective: To deeply explore the clinical value of combined detection of serum homocysteine (Hcy) and uric acid (UA) in hypertensive patients. Methods: A total of 63 hypertensive patients admitted to the Third People's Hospital of Nanning from January 1, 2022, to December 31, 2023, were selected as the hypertensive group, and 63 healthy subjects during the same period were selected as the healthy group. Serum Hcy and UA were detected in both groups. The detection levels were compared between the two groups, and the differences in serum Hcy and UA levels among hypertensive patients at different grades in the hypertensive group were analyzed. Results: The levels of Hcy and UA in the healthy group were significantly lower than those in the hypertensive group ($P < 0.05$). In the hypertensive group, the serum Hcy and UA levels of patients with grade 3 hypertension were significantly higher than those of patients with grade 1 and grade 2 hypertension, and with the increase of hypertension grade, the levels of these two indicators also increased ($P < 0.05$). Conclusion: The combined detection of serum Hcy and UA in hypertensive patients can effectively distinguish hypertensive patients from healthy people, assist in evaluating the severity of hypertension, and provide important clinical evidence for the prevention, evaluation of the condition, and subsequent treatment of hypertension.

1. INTRODUCTION

Hypertension, a common chronic disease, has seen a significant upward trend in its incidence globally in recent years. According to relevant reports, the total number of hypertensive patients in China has reached 200 million [1, 2]. It not only severely affects the quality of life of patients but also increases the risk

*Co-first author.
#Corresponding author.

of various complications such as cardiovascular and cerebrovascular diseases, imposing a heavy burden on public health [3-5]. Especially against the backdrop of the accelerated aging of the population and the extension of the average life expectancy, the medical needs of elderly hypertensive patients are continuously increasing, making the prevention and treatment of hypertension an important issue that needs to be addressed urgently [6, 7]. The schematic diagram of the three-dimensional image of the pathogenesis of hypertension is shown in **Figure 1** below.

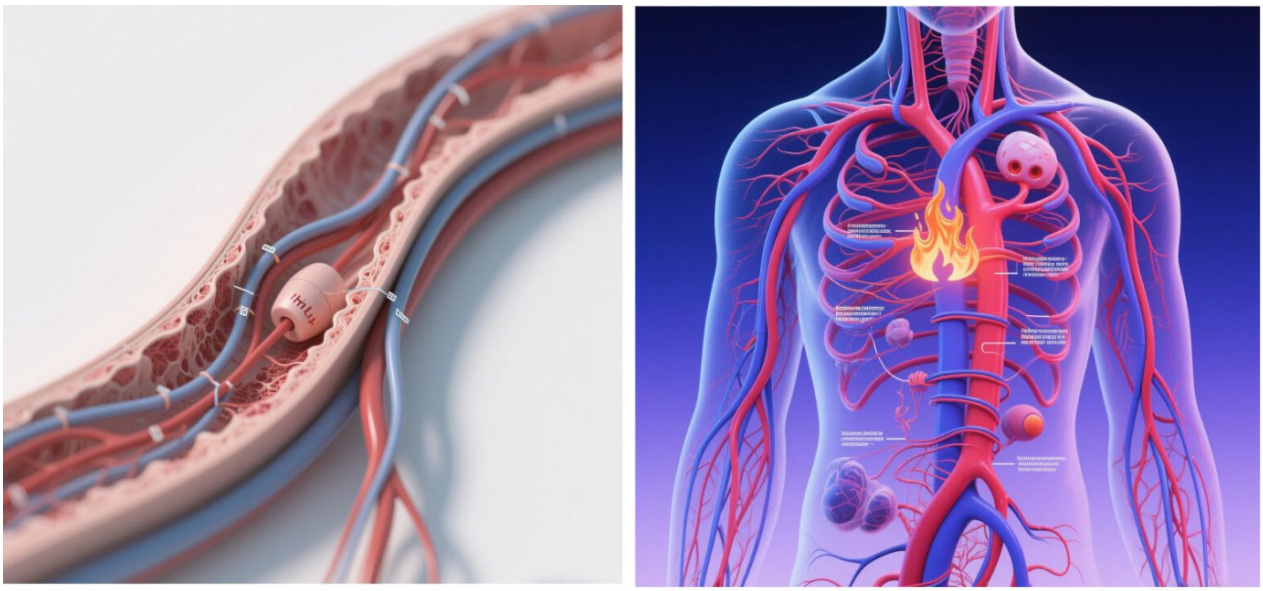

Figure 1. Schematic diagram of the three-dimensional image of the pathogenesis of hypertension.

Serum homocysteine (Hcy) and uric acid (UA), as important metabolic indicators in the human body, have gradually attracted attention for their roles in hypertensive diseases. Hcy, a sulfur-containing amino acid, is produced by the metabolism of methionine and has multiple physiological functions in the body. However, high levels of Hcy may cause damage to blood vessels [8-10]. UA is the end product of purine metabolism, and changes in its level are closely related to the occurrence and development of various diseases [11-13]. Existing studies have shown [14-16] that the individual detection of Hcy or UA has certain application value in the diagnosis of hypertensive diseases. However, the application effect of the combined detection of the two in the diagnosis of hypertensive diseases requires further in-depth research. Based on this, this study conducts a controlled study on hypertensive patients and healthy subjects, systematically analyzes the clinical value of the combined detection of serum Hcy and UA in hypertensive diseases, and aims to provide more powerful evidence for the early diagnosis, condition assessment, and treatment of hypertension.

2. MATERIALS AND METHODS

2.1. General Information

In this study, 63 hypertensive patients admitted to our hospital from January 1, 2022, to December 31, 2023, and 63 healthy subjects during the same period were selected as the research objects. According to the presence or absence of hypertensive diseases, the participants were divided into the hypertensive group (n = 63) and the healthy group (n = 63). All research objects have obtained approval from the ethics committee, have self-awareness, and voluntarily signed the informed consent form [17].

In the hypertensive group, there were 39 males and 24 females; the age range was 50 - 85 years old, with an average age of (70.35 ± 3.25) years; the hypertension classification: 2 cases of grade 1 (mild), 42 cases of

grade 2 (moderate), and 19 cases of grade 3 (severe); the disease course was 1 - 9 years, with an average disease course of (4.25 ± 2.15) years. In the healthy group, there were 41 males and 22 females; the age was 50 - 85 years old, with an average age of (70.15 ± 3.32) years. Through statistical analysis, there were no significant differences in the basic information of the research objects between the two groups (P > 0.05), and they had good comparability. The specific data are shown in Table 1.

Table 1. Comparison of serum homocysteine and uric acid levels between the two groups ($\bar{x}$ ± s, μmol/L).

Group	Hcy	UA
Healthy group (n = 63)	8.23 ± 2.18	248.29 ± 50.89
Hypertensive group (n = 63)	20.89 ± 3.45	352.47 ± 60.18
t	24.623	10.492
P	<0.001	<0.001

Inclusion criteria: 1) The research objects have clear consciousness, normal communication ability, and basic reading and writing ability; 2) Complete clinical data; 3) The patients in the hypertensive group meet the diagnostic criteria for hypertension [18].

Exclusion criteria: 1) Those with decreased or failed function of important organs such as the heart, liver, and kidney; 2) Those with intellectual or conscious disorders; 3) Those suffering from other infectious diseases such as hepatitis B; 4) Those who are unwilling to sign the informed consent form.

2.2. Detection Methods

Before the routine blood test, the nursing staff should explain the purpose, process, and possible risks of the detection in detail to all the subjects, and ensure that the subjects fully understand and sign the informed consent form. At the same time, the nursing staff should have a comprehensive understanding of the health status and medication use of the subjects [19]. When collecting blood, guide the subjects to expose their upper limb arms and place them on the blood collection table. After strictly disinfecting the blood collection site, use a disposable vacuum blood collection tube to collect about 2 mL of venous blood. After the blood sample is collected, it should be fully diluted and shaken well, and then sent to the laboratory for detection.

The routine blood test was carried out using the Mindray BC – 6800 Plus hematology analyzer. The Beckman AU5800 automatic biochemical analyzer was used to determine the level of Hcy in patients by the cyclic enzyme method, and the UA level in patients was detected by the uricase colorimetry method. The homocysteine detection kit (Production License of Medical Devices in Jiangsu Province, No. 20010367) was provided by Beckman Coulter Experimental Systems (Suzhou) Co., Ltd., and the UA detection kit (Production License of Medical Devices in Zhejiang Province, No. 20130042) was provided by Meikang Biotech Co., Ltd. The parameter settings and reagent operations of all instruments were strictly carried out in accordance with the instructions [20-22].

The normal reference range of blood UA: for males, it is 208 - 428 μmol/L; for females, it is 155 - 357 μmol/L. The normal reference range of blood Hcy: 5 - 15 μmol/L.

2.3. Observation Indicators

1) Compare the levels of serum homocysteine and uric acid between the two groups of research objects.

2) Compare the levels of serum homocysteine and uric acid among hypertensive patients at different hypertension grades in the hypertensive group.

2.4. Statistical Processing

The data obtained in this study were statistically analyzed using SPSS30.0 software. The measurement data were expressed as ($\bar{x} \pm s$), and the t-test was used for comparison between groups; the count data were expressed as n (%), and the chi-square test was used for comparison between groups. A $P < 0.05$ was considered to indicate a statistically significant difference.

3. RESULTS

3.1. Comparison of Serum Homocysteine and Uric Acid Levels between the Two Groups

The levels of Hcy and UA in the healthy group were significantly lower than those in the hypertensive group, and the difference was statistically significant ($P < 0.05$). The detailed data are shown in Table 1.

3.2. Comparison of Serum Homocysteine and Uric Acid Levels among Hypertensive Patients at Different Hypertension Grades in the Hypertensive Group

The levels of Hcy and SUA in patients with grade 3 hypertension were significantly higher than those in patients with grade 1 and grade 2 hypertension, and with the increase of hypertension grade, the levels of these two indicators also increased, and the difference was statistically significant ($P < 0.05$). The specific data are shown in Table 2.

Table 2. Comparison of serum homocysteine and uric acid levels among hypertensive patients at different hypertension grades in the hypertensive group ($\bar{x} \pm s$, μmol/L).

Group	Hcy	UA
Grade 1 (2 cases)	16.47 ± 2.24	310.28 ± 42.48
Grade 2 (42 cases)	21.09 ± 3.10	332.45 ± 53.42
Grade 3 (19 cases)	24.36 ± 6.35	451.36 ± 90.17
f	12.683	6.606
P	0.002	0.037

4. DISCUSSION

The main feature of hypertension is the abnormal increase in blood pressure, which can lead to varying degrees of increase in systolic and diastolic blood pressure, and then trigger symptoms such as nausea and dizziness. Some patients may also have lesions in organs such as the heart [23-25]. With the acceleration of the modern life rhythm, the work and life pressure faced by people is increasing, and the disorder of the work and rest and eating habits of young people makes the risk of hypertension gradually spread to the young population [26, 27]. Therefore, the early prevention and intervention of hypertension are of great significance. Studies have shown [28-30] that understanding the risk factors and Risk of disease of hypertension in advance can help reduce medical costs, reduce mortality, and thus improve the quality of life of patients.

Serum Hcy and UA play important roles in the pathogenesis and progression of hypertension. As a metabolite of methionine, Hcy contains sulfur-based amino acids and has an oxidative effect, which can increase the oxygen content of free radicals and also affect ions, thereby damaging blood vessels [31-33]. In addition, Hcy can also interfere with the oxidation and synthesis processes of substances such as nitric oxide, arachidonic acid, and thrombin, damage the function of vascular endothelial cells, promote thrombosis, and increase the risk of cardiovascular diseases [34-36].

UA, as the final product of purine metabolism in the body, also has important significance in the occurrence and development of hypertension. Research has found [37-39] that the increase in serum uric acid level is a significant feature in insulin resistance, and insulin resistance is one of the key factors leading to hypertension. Therefore, the increase in serum uric acid level is considered an independent risk factor for the occurrence of hypertension [40-42]. In this study, the ability of the kidneys of hypertensive patients to clear uric acid decreases, leading to the accumulation of uric acid in the body and then an increase in the level of serum uric acid. Some studies suggest that the mechanism by which hypertension leads to hyperuricemia may be related to the excitation of the renin-angiotensin system and the downregulation of the expression of neuronal nitric oxide synthase [43-45].

The results of this study show that the levels of Hcy and UA in the healthy group are significantly lower than those in the hypertensive group, indicating that the combined detection of serum Hcy and UA can provide a powerful basis for the condition assessment and diagnosis of hypertension. At the same time, the levels of Hcy and SUA in patients with grade 3 hypertension are significantly higher than those in patients with grade 1 and grade 2 hypertension, and the higher the hypertension grade, the higher the levels of these two indicators, indicating that the combined detection of serum Hcy and UA can not only determine whether the subjects have hypertension but also evaluate the severity of hypertension based on the detection data. This result is consistent with the research of Wang Rui and other scholars [13], further confirming the effectiveness of Hcy detection in the diagnosis and condition judgment of essential hypertension.

In conclusion, the combined detection of serum Hcy and UA has important clinical value in the diagnosis and condition assessment of hypertension and can be used as an effective reference indicator for clinical diagnosis. However, this study also has certain limitations.

5. CONCLUSION

This study, through a controlled study of hypertensive patients and healthy subjects, has confirmed the important clinical value of the combined detection of serum homocysteine and uric acid in hypertensive patients. Compared with the healthy population, the levels of serum homocysteine and uric acid in hypertensive patients are significantly higher, and with the increase of hypertension classification, the levels of these two indicators also continue to rise. Therefore, the combined detection of serum homocysteine and uric acid can assist in evaluating the grade of hypertension and provide important reference evidence for the prevention, condition monitoring, and subsequent treatment of hypertension. In clinical practice, it can be used as a routine detection item for the diagnosis and condition assessment of hypertension to improve the diagnosis and treatment level of hypertension and the prognosis of patients.

6. LIMITATIONS OF THE STUDY

The sample size of this study is relatively small, which may lead to certain deviations in the research results. In subsequent studies, the sample size should be expanded, and multi-center and large-sample studies should be carried out to more accurately verify the universality and reliability of the research results of this study. In addition, this study only explored the application of the combined detection of serum Hcy and UA in hypertensive diseases, and did not conduct in-depth analysis of other factors that may affect the condition of hypertension, such as genetic factors and lifestyle. In future research, relevant correlation studies can be further carried out, and multiple factors can be comprehensively considered to provide a more comprehensive theoretical basis for the prevention and treatment of hypertension.

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DECLARATION OF INTERESTS

I declare that there are no conflicts of interest in this study. During the research process, no funding or interference from interested parties that may affect the fairness of the research results was accepted. All research data are true and reliable, and the research conclusions are drawn based on objective data analysis.

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