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Analysis of the Improvement of Inflammatory Factor Levels in Patients with Coronary Heart Disease and Hyperlipidemia Treated with Alirocumab and Atorvastatin

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Abstract: *Objective*: To explore the efficacy of atorvastatin combined with alirocumab in the treatment of patients with coronary heart disease and hyperlipidemia. *Methods*: The study period was from June 2024 to June 2025. Patients with coronary heart disease and hyperlipidemia (n = 506) who received diagnosis and treatment in our hospital during this time period were included as the study subjects. The observation group and the control group were divided based on a random number table, with 253 patients in each group. Clinical treatment indicators were compared between the groups. *Results*: The total effective rate in the observation group was higher than that in the control group ($P < 0.05$). After treatment, there were significant differences in blood lipid levels, cardiac function indicators, coronary microcirculation, and inflammatory factor levels between the groups ($P < 0.05$). There was no significant difference in the incidence of adverse reactions between the two groups ($P > 0.05$). *Conclusion*: The combination of atorvastatin and alirocumab in the treatment of patients with coronary heart disease and hyperlipidemia is not only beneficial for improving cardiac function and blood lipid symptoms, but also has a prominent effect on coronary microcirculation and anti-inflammatory ability. The treatment is effective and safe, and can be promoted.

Keywords: Alirocumab; Atorvastatin; Coronary heart disease; Hyperlipidemia; Inflammatory factors

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1. Introduction

When atherosclerotic changes occur in the coronary arteries within the body, the blood vessel lumen may become stenosed or occluded, leading to impaired myocardial blood and oxygen supply. This is the etiology of coronary heart disease. In such patients, blood lipid levels are significantly elevated. Once a large amount of lipids accumulates in the cardiovascular system, it can lead to comorbid hyperlipidemia [1]. To ensure clinical efficacy, it is necessary to actively explore and develop scientific lipid-lowering and anti-inflammatory regimens. Among

them, atorvastatin is commonly used in the treatment of patients with coronary heart disease complicated by hyperlipidemia, which can effectively regulate blood lipids and has unique advantages in the treatment of coronary heart disease [2]. However, long-term use of this drug can also increase the body's drug resistance, and its lipid-lowering effect is less than satisfactory. Currently, a novel lipid-lowering drug, alirocumab, has been widely used in clinical practice. It can rapidly lower blood lipid levels, inhibit the expression of inflammatory factors, and reduce the proinflammatory response of the arterial wall, thereby achieving the goal of relieving atherosclerosis and improving prognosis [3]. Therefore, it is practically meaningful to take patients with coronary heart disease complicated by hyperlipidemia as the research object and to deeply explore the feasibility of promoting combination therapy.

2. Materials and methods

2.1. Clinical data

A total of 506 patients with coronary heart disease complicated by hyperlipidemia were included in the study. They were treated between June 2024 and June 2025. The patients were randomly divided into an observation group (n = 253) and a control group (n = 253) using a random number table method. In the control group, there were 153 males and 100 females, with ages ranging from 42 to 78 years old, and an average age of (55.97 ± 7.23) years old. In the observation group, the male-to-female ratio was 150:103, with the oldest patient being 77 years old and the youngest being 44 years old, and an average age of (56.04 ± 7.27) years old. A comparison of baseline data between the two groups showed no significant difference ($P > 0.05$), indicating good comparability.

Inclusion criteria: confirmed diagnosis of coronary heart disease combined with hyperlipidemia; normal communication skills; strong tolerability. Exclusion criteria: allergy to the study drug; comorbidity with malignant tumors; coagulation disorders.

2.2. Methods

The control group patients took atorvastatin once a day before bedtime, with a dose of 20 mg. Based on the medication of the control group, the observation group was administered subcutaneously (Alirocumab Injection). The initial dose was controlled at 75 mg, injected every two weeks. During treatment, the dosage was adjusted appropriately based on LDL-C levels. If necessary, the dose could be increased to 150 mg.

Both groups were treated continuously for 3 months. During treatment, all patients were required to make adjustments in diet and exercise, ensuring a low-fat, low-salt diet and moderate exercise, correcting unhealthy lifestyle habits, and providing necessary guarantees for improving treatment effectiveness.

2.3. Evaluation indicators

Systematically evaluate the treatment effect and adverse reactions of patients. The evaluation of treatment effect is based on the improvement of patients' cardiac function and blood lipids, which is divided into three levels: marked effect, effective, and ineffective. If, after treatment, the patient's cardiac function improves by 2 grades and hyperlipidemia symptoms completely disappear, it is judged as a marked effect; effective means that the patient's cardiac function improves by 1 grade and hyperlipidemia symptoms improve; if the patient's cardiac function and hyperlipidemia symptoms do not improve after treatment, it is considered ineffective. The total effective rate of treatment is the sum of the marked effective rate and the effective rate. Observe and record the induration, bruising at the injection site, muscle soreness, and diarrhea symptoms of patients, and calculate the incidence of adverse reactions.

Evaluate blood lipids, cardiac function indicators, coronary microcirculation, and inflammatory factor levels before and after treatment between groups. Blood lipid indicators mainly include TC, TG, LDL-C, and HDL-C. These indicators require the collection of venous blood from patients, followed by serum separation after processing, and are completed with the help of an automatic blood analyzer. LVDS, LVDD, and LVEF are the cardiac function indicators included in the study, and the detection system used is Doppler ultrasound. Coronary microcirculation indicators mainly include resting and hyperemic CFV and CFVR, which are mainly obtained through transthoracic Doppler ultrasonography. The detection of inflammatory factor indicators requires the extraction of fasting venous blood from patients, with a dose of 5 mL. hs-CRP is detected by immune scattering turbidimetry, while the determination of IL-6 and TNF-α is performed using enzyme-linked immunosorbent assay.

2.4. Statistical analysis

Statistical software SPSS version 21.0 was used to analyze the data, and $P < 0.05$ indicates a statistically significant difference.

3. Results

3.1. Comparison of treatment effects between the observation group and the control group

The total effective rate of the observation group was compared with that of the control group, $P < 0.05$ (**Table 1**).

Table 1. Comparison the treatment effects of the two groups of patients (*n*/%)

Group	n	Markedly effective	Effective	Ineffective	Total effective rate
Observation	253	160	87	6	247 (97.63)
Control	253	138	100	15	238 (94.07)
χ^2 value					4.0242
P value					0.0448

3.2. Study on blood lipid indicators before and after treatment in both groups

Before treatment, there was no significant difference in blood lipid indicators between the groups ($P > 0.05$). After treatment, the relevant indicators in the observation group were significantly different from those in the control group ($P < 0.05$) (**Table 2**).

Table 2. Analysis of the changes in blood lipid indicators in the observation group and the control group (mean ± SD)

Group	n	TC (mmol/L)		TG (mmol/L)		LDL-C (mmol/L)		HDL-C (mmol/L)	
		Before	After	Before	After	Before	After	Before	After
Observation	253	6.79 ± 1.12	3.66 ± 0.68	3.95 ± 0.72	1.74 ± 0.43	4.04 ± 0.77	1.79 ± 0.34	1.11 ± 0.47	1.42 ± 0.53
Control	253	6.82 ± 1.08	4.76 ± 1.12	3.99 ± 0.79	2.28 ± 0.63	4.01 ± 0.79	3.19 ± 0.73	1.13 ± 0.50	1.10 ± 0.24
t-value		0.3067	13.3534	0.5952	11.2607	0.4325	27.6524	0.4636	8.7484
p-value		0.7592	0.0000	0.5520	0.0000	0.6655	0.0000	0.6431	0.0000

3.3. Comparison of changes in cardiac function indicators between the observation group and the control group

After treatment, there were significant differences in various cardiac function indicators between the groups ($P < 0.05$) (**Table 3**).

Table 3. Comparison of cardiac function indicators before and after treatment between the two groups (mean ± SD)

Group	n	LVDS (mm)		LVDD (mm)		LVEF (%)	
		Before	After	Before	After	Before	After
Observation	253	46.32 ± 8.32	37.79 ± 6.22	58.39 ± 6.69	50.53 ± 4.27	37.53 ± 4.69	52.23 ± 7.74
Control	253	46.35 ± 8.35	44.09 ± 6.26	58.43 ± 6.73	54.02 ± 4.65	37.55 ± 4.72	48.04 ± 7.09
t-value		0.0405	11.3553	0.0670	8.7931	0.0478	6.3494
p-value		0.9677	0.0000	0.9466	0.0000	0.9619	0.0000

3.4. Analysis of coronary microcirculation before and after treatment in both groups

Before treatment, there was no significant difference in relevant indicators between the groups ($P > 0.05$). After treatment, the indicators in the observation group were better than those in the control group ($P < 0.05$) (**Table 4**).

Table 4. Changes in coronary microcirculation in the observation group and control group (mean ± SD)

Group	n	Resting CFV (cm/s)		Hyperemic CFV (cm/s)		CFVR	
		Before	After	Before	After	Before	After
Observation	253	24.23 ± 3.75	27.96 ± 3.32	60.32 ± 8.25	69.98 ± 9.86	2.54 ± 0.23	2.97 ± 0.32
Control	253	24.21 ± 3.79	25.03 ± 3.24	60.35 ± 8.21	64.14 ± 10.29	2.57 ± 0.21	2.68 ± 0.26
t-value		0.0597	10.0463	0.0410	6.5180	1.5321	11.1875
p-value		0.9524	0.0000	0.9673	0.0000	0.1261	0.0000

3.5. Comparison of inflammatory factor levels between the observation group and the control group

After treatment, there were significant differences in inflammatory factor indicators between the groups ($P < 0.05$) (**Table 5**).

Table 5. Comparison of inflammatory factor levels before and after treatment between the two groups (mean ± SD)

Group	n	hs-CRP (mg/L)		IL-6 (ng/L)		TNF-α (ng/L)	
		Before	After	Before	After	Before	After
Observation	253	7.99 ± 1.79	4.00 ± 0.09	23.38 ± 4.96	16.28 ± 4.33	7.43 ± 1.42	1.89 ± 0.33
Control	253	7.95 ± 1.82	5.86 ± 1.34	23.43 ± 4.93	20.25 ± 4.53	7.47 ± 1.48	2.96 ± 0.57
t-value		0.2492	22.0288	0.1137	10.0768	0.3102	25.8404
p-value		0.8033	0.0000	0.9095	0.0000	0.7565	0.0000

3.6. Study on adverse reactions in both groups

The total incidence rate in the observation group was compared with that in the control group ($P > 0.05$) (**Table 6**).

Table 6. Analysis of adverse reactions in the observation group and control group (*n*/%)

Group	n	Injection site induration/ecchymosis	Myalgia	Diarrhea	Total incidence rate
Observation	253	10	10	7	27 (10.67)
Control	253	8	10	5	23 (9.09)
χ^2 value					0.3551
P value					0.5512

4. Discussion

Coronary heart disease, also known as coronary atherosclerotic heart disease, is a common cardiovascular disease. Currently, the clinical incidence and mortality of this disease are increasing year by year. After falling ill, patients are prone to symptoms such as angina pectoris and arrhythmia. If the condition is severe, it can also cause a series of complications, significantly increasing the risk of sudden death and posing a greater threat to the patient's life and health [4]. Clinically, it is believed that the independent risk factor for coronary heart disease is lipid metabolism dysfunction. Therefore, the key to clinical treatment for patients with coronary heart disease and dyslipidemia lies in regulating their lipid metabolism status. Patients with hyperlipidemia usually consider statins as the preferred treatment option, which can lower their lipid levels, significantly inhibit platelet aggregation, greatly reduce the risk of thrombosis, and also decrease the likelihood of adverse cardiovascular events [5]. However, it is difficult for patients with coronary heart disease and hyperlipidemia to achieve ideal efficacy by relying only on statins. Some patients still find it challenging to significantly regulate their lipid levels after medication, and coupled with the unsatisfactory control of inflammatory factors, they are more prone to cardiovascular events. Therefore, in the clinical treatment of such patients, it is still necessary to combine statins with other lipid-lowering drugs to promote the improvement of lipid levels and the regulation of inflammatory factors. Among them, Alirocumab is a proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitor. After administration, it can effectively bind to PCSK9, effectively avoiding the acceleration of LDL receptor degradation, and promoting the increase in the number of these receptors to a certain extent, while the LDL-C level decreases accordingly. Moreover, when used in the treatment of patients with coronary heart disease and hyperlipidemia, this drug can not only play a role in regulating blood lipids but also fully exert its own anti-inflammatory effects, which is beneficial for reducing the level of inflammatory factors in patients and ensuring the stability of atherosclerotic plaques [6]. In terms of mechanism of action, atorvastatin inhibits cholesterol synthesis, leading to a reduction in blood lipid levels. This, in turn, fully exerts its anti-inflammatory effect, making plaques more stable. Alirocumab primarily regulates LDLR metabolism, leading to a decrease in LDL-C levels and prominent anti-inflammatory effects. The combined use of these two drugs achieves effective complementarity between the two mechanisms, laying a solid foundation for regulating blood lipid levels and managing inflammation [7].

Based on the comparison of the aforementioned data, it is evident that the overall effective rate of the observation group after combined therapy is significantly higher than that of the control group, with a *P*-value less than 0.05. This finding suggests that the synergistic effect of the two drugs is more optimal, leading to a significant enhancement in lipid-lowering efficacy. The underlying reason is that Alirocumab, as a PCSK9 inhibitor, effectively suppresses PCSK9 during the treatment of patients with coronary heart disease complicated by hyperlipidemia. This suppression ultimately achieves the therapeutic goals of reducing blood lipid levels and stabilizing plaques. Upon treatment, a comparison of coronary microcirculation indicators between the groups

reveals a statistically significant difference, with a *P*-value less than 0.05. This result confirms the beneficial effects of combination therapy on improving coronary microcirculation in patients. The primary reason for this improvement is Alirocumab's faster and more sustained lipid regulation, coupled with its ability to suppress inflammatory responses within the patient's body. In terms of medication safety, there is no statistically significant difference in the overall incidence of adverse reactions between the groups, with a *P*-value greater than 0.05. This finding indicates that both the combination therapy and monotherapy regimens are safe and do not cause severe adverse reactions, demonstrating good patient tolerance. A comparison of lipid profile indicators between the observation group and the control group yields a statistically significant difference, with a *P*-value less than 0.05. Upon analysis, it is evident that Alirocumab contributes to a reduction in TC levels within the body, particularly when combined with statins, leading to more pronounced effects.

Furthermore, there are significant differences in cardiac function indicators between the groups after treatment, with a *P*-value less than 0.05. This finding further corroborates the efficacy and value of combination therapy in improving patients' cardiac function. After treatment, the levels of various inflammatory factors in the observation group are significantly lower than those in the control group, with a *P*-value less than 0.05. Among these factors, hs-CRP is an acute-phase reaction protein. When activated, the liver increases its synthesis and releases it into the bloodstream, thus reflecting the degree of inflammation within the human body. IL-6, on the other hand, is a multifunctional cytokine that plays a crucial role in inflammatory signaling pathways. It can activate inflammatory cells and even accelerate their proliferation, leading to further exacerbation of inflammatory responses. TNF-α, secreted by activated macrophages, can induce vascular endothelial cells to express adhesion molecules, promoting the adhesion and infiltration of inflammatory cells and playing a significant role in the formation and development of atherosclerotic plaques. Clinically, the combination of alirocumab and atorvastatin can significantly reduce the level of inflammatory factors, mainly due to the synergistic mechanism of the two drugs. The use of atorvastatin can inhibit HMG-CoA reductase, significantly reducing the amount of cholesterol synthesized to achieve the goal of lowering blood lipids. This drug also has antioxidant and anti-inflammatory effects, significantly reducing the release and production of inflammatory factors. Although monotherapy can reduce patients' inflammatory factor levels, its efficacy is relatively limited for patients with significant inflammatory responses. The use of alirocumab can exert an anti-inflammatory effect while lowering lipids. Based on the regulation of immune cell function, it inhibits the activation of inflammatory signaling pathways, thereby reducing the level of inflammatory factors. The combination of the two drugs can enhance therapeutic effects through different targets, suppressing inflammatory responses.

5. Conclusion

Overall, in the clinical treatment of patients with coronary heart disease and hyperlipidemia, the combined use of alirocumab and atorvastatin fully exerts their anti-inflammatory effects, blocks the activation pathway of inflammatory signaling, and improves the vascular microenvironment. This ensures the normal function of patients' vascular endothelium and the stability of atherosclerotic plaques, demonstrating the synergistic value of the combination therapy in regulating blood lipids and improving inflammation. To further confirm the value of this drug treatment regimen, it is still necessary to appropriately expand the research sample and enrich data sources in subsequent studies.

Disclosure statement

The authors declare no conflict of interest.

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