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Impact of Vericiguat on Ventricular Remodeling and Cardiac Function in Patients with Chronic Severe Heart Failure

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Abstract

Objective: To investigate the impact of vericiguat on ventricular remodeling and cardiac function in patients with chronic severe heart failure. **Methods:** From January 2021 to June 2023, 93 patients with chronic severe heart failure admitted to our hospital were randomly assigned to two groups using an envelope. The observation group (46 patients) and the control group (47 patients). The control group received quadruple therapy, while the observation group received additional vericiguat treatment based on the control group's regimen. The levels of ventricular remodeling (left ventricular posterior wall thickness, LVPWT; left ventricular mass index, LVMI) and cardiac function (left ventricular end-diastolic volume index, LVEDVI; left ventricular ejection fraction, LVEF) were compared between the two groups. **Results:** After treatment, both LVPWT and LVMI decreased significantly in both groups, with a greater decrease observed in the observation group compared to the control group ($P < 0.05$). Additionally, LVEDVI and LVEF increased significantly, with the observation group showing better improvement than the control group ($P < 0.05$). **Conclusion:** The addition of vericiguat to quadruple therapy for patients with chronic severe heart failure can improve ventricular remodeling and cardiac function levels, making it worthy of promotion.

Keywords

Chronic severe heart failure; Vericiguat; Ventricular remodeling; Cardiac function

Chronic severe heart failure (CSHF) is a clinical syndrome primarily characterized by ventricular remodeling and progressive deterioration of cardiac function, with high morbidity, rehospitalization rates, and poor prognosis posing a severe threat to patients' quality of life [1]. Despite significant advancements in heart failure treatment in recent years, and with quadruple therapy (ARNI/ACEI/ARB, β-blockers, aldosterone receptor antagonists, and SGLT2 inhibitors) becoming the core regimen recommended in guidelines, some patients still respond poorly to existing treatments, experiencing continuous ventricular remodeling and ineffective improvement in cardiac function [2]. Therefore, exploring novel drugs to further optimize treatment regimens has become an urgent clinical challenge. Vericiguat, as a new-generation soluble guanylate cyclase (sGC) stimulator, directly activates sGC to increase intracellular cyclic guanosine monophosphate (cGMP) levels, thereby improving myocardial diastolic function, inhibiting myocardial fibrosis, and vascular remodeling. In theory, it has the potential to reverse ventricular remodeling and improve cardiac function [3, 4]. However, current clinical evidence regarding the use of vericiguat in patients with CSHF remains limited. This study, adopting a prospective randomized controlled design, aims to systematically evaluate the interventional effects of vericiguat combined with quadruple therapy on ventricular remodeling and cardiac function in patients with CSHF, with the intention of providing a scientific basis for optimizing clinical treatment strategies.

1. Materials and Methods

1.1 General Information

Ninety-three patients with chronic severe heart failure from our hospital between January 2021 and June 2023 were selected and randomly assigned into two groups using the envelope method: the observation group with 46 patients and the control group with 47 patients. There were no significant differences in baseline characteristics between the two groups ($P > 0.05$), as detailed in Table 1. This study was approved by the hospital's ethics committee and adhered to the relevant ethical principles outlined in the Helsinki Declaration.

Table 1. Comparison of General Information Between the Two Groups ($\bar{x} \pm s$ /n)

General Information Gender	Observation Group (n=46)	Control Group (n=47)	t/x^2	P
Male/Female	26/20	28/19	0.089	0.765
Age (years)	46-63	45-64		
	53.51±4.66	53.72±5.71	0.194	0.847

1.2 Inclusion and Exclusion Criteria

Inclusion Criteria: (1) Age of 18 years or older; (2) Diagnosed with chronic severe heart failure, with NYHA functional classification of I to IV; (3) Left ventricular ejection fraction (LVEF) < 40%; (4) Patients who have signed the informed consent form and agreed to participate.

Exclusion Criteria: (1) Patients with severe hepatic or renal insufficiency; (2) Patients with other systemic diseases in their terminal stage; (3) Patients who have undergone cardiac surgery or interventional therapy within the last three months.

1.3 Methods

The control group received quadruple therapy: Irbesartan was orally administered once daily at a fixed time, with an initial dose of 150 mg that could be increased to 300 mg/day; Metoprolol Succinate Extended-Release Tablets were taken once daily, starting at a dose of 47.5 mg and adjusted according to heart rate and blood pressure, with a maximum dose of 190 mg/day; Eplerenone was administered once daily at an initial dose of 25 mg, which could be adjusted to 50 mg/day based on serum potassium and blood pressure levels; and Dapagliflozin Tablets were taken once daily at a dose of 10 mg.

The observation group received Vericiguat therapy in addition to the quadruple therapy received by the control group: 2.5 mg once daily, with the dose doubled every 1-2 weeks until the patient's tolerance was reached, up to a maximum maintenance dose of 10 mg/day.

1.4 Observation Indicators

1.4.1 Ventricular Remodeling

Ventricular remodeling, including left ventricular posterior wall thickness (LVPWT) and left ventricular mass index (LVMI), was observed and compared between the two groups before and after treatment.

1.4.2 Cardiac Function

Cardiac function, including left ventricular end-diastolic volume index (LVEDVI) and left ventricular ejection fraction (LVEF), was observed and compared between the two groups before and after treatment.

1.5 Statistical Methods

Data analysis was conducted using SPSS 21.0 software in our hospital. Measurement data were expressed as mean ± standard deviation and confirmed to be normally distributed, with comparisons between groups performed using the t-test. Count data were expressed as relative numbers, and differences between groups were analyzed using the χ^2 test. A P-value < 0.05 was considered statistically significant.

2. Results

2.1 Comparison of Ventricular Remodeling Levels Between the Two Groups

Before treatment, the levels of LVPWT and LVMI were comparable between the two groups ($P > 0.05$). After treatment, both indicators significantly decreased in both groups, with the observation group showing a greater degree of improvement compared to the control group ($P < 0.05$) (see Table 2 for details).

Table 2. Comparison of Ventricular Remodeling Levels Before and After Treatment Between the Two Groups ($\bar{x} \pm s$)

Grouping	Number of Cases (n)	LVPWT (mm)		LVMI (g/m^2)	
		Before Treatment	After Treatment	Before Treatment	After Treatment
Observation Group	46	12.59±3.11	7.09±0.87*	147.88±16.21	112.08±15.16*
Control Group	47	12.46±3.08	8.74±1.43*	146.94±16.53	121.46±14.93*
t	-	0.203	6.705	0.277	3.006
P	-	0.840	<0.001	0.783	0.003

Note: *$P < 0.05$ compared with before treatment within the same group.

2.2 Comparison of Cardiac Function Levels Between the Two Groups

Before treatment, the cardiac function indicators were comparable between the two groups ($P > 0.05$). After treatment, both LVEDVI and LVEF levels significantly increased in both groups, with more significant improvements observed in the observation group ($P < 0.05$) (see Table 3 for details).

Table 3. Comparison of Cardiac Function Levels Before and After Treatment Between the Two Groups ($\bar{x} \pm s$)

Grouping	Number of Cases (n)	LVEDVI (ml)		LVEF (%)	
		Before Treatment	After Treatment	Before Treatment	After Treatment
Observation Group	46	67.43±2.26	75.06±2.27*	35.29±2.93	49.31±2.26*
Control Group	47	67.33±2.41	71.09±1.93*	36.09±3.11	42.93±2.54*
t	-	0.206	9.093	1.276	12.816
P	-	0.837	<0.001	0.205	<0.001

Note: *$P < 0.05$ compared with before treatment within the same group.

3. Discussion

In this study, 93 patients with chronic severe heart failure were enrolled and randomly divided into an observation group (quadruple therapy + Vericiguat) and a control group (quadruple therapy alone) to systematically analyze the effects of Vericiguat on ventricular remodeling and cardiac function. The results showed that after treatment, the left ventricular posterior wall thickness (LVPWT) in the observation group decreased from 12.59 ± 3.11 mm to 7.09 ± 0.87 mm, and the left ventricular mass index (LVMI) decreased from 147.88 ± 16.21 g/m² to 112.08 ± 15.16 g/m², significantly better than those in the control group ($P < 0.05$). Meanwhile, the left ventricular end-diastolic volume index (LVEDVI) in the observation group increased from 67.43 ± 2.26 ml to 75.06 ± 2.27 ml, and the left ventricular ejection fraction (LVEF) increased from 35.29 ± 2.93% to 49.31 ± 2.26%, with significantly greater improvements compared to the control group ($P < 0.001$). These data indicate that Vericiguat combined with quadruple therapy can effectively inhibit the process of ventricular remodeling and promote the recovery of cardiac structure and function, providing an important supplement for the treatment of chronic severe heart failure.

The underlying mechanism may be that Vericiguat activates the sGC-cGMP signaling pathway, directly targeting cardiomyocytes and vascular endothelium, demonstrating unique advantages in improving ventricular compliance and reducing cardiac load [5]. This study found that its combination with quadruple therapy can further optimize the hemodynamic status of patients with heart failure, reduce myocardial fibrosis and ventricular mass, thereby delaying disease progression. This result has important guiding significance for clinical practice: for patients with chronic severe heart failure who have limited responses to traditional treatment, the addition of Vericiguat may become an effective strategy to improve prognosis and reduce rehospitalization rates [6]. In addition, the study results provide new insights into early intervention and individualized treatment for heart failure, contributing to the promotion of precision treatment models oriented by pathophysiological mechanisms.

In summary, Vericiguat significantly inhibits ventricular remodeling and improves cardiac function by activating the sGC-cGMP pathway. Its combination with quadruple therapy provides a superior hemodynamic intervention strategy for patients with chronic severe heart failure, possessing significant clinical promotion value.

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