Dapagliflozin Combined with Conventional Anti-heart Failure Drugs in the Treatment of Chronic Heart Failure: A Clinical Efficacy Observation

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Abstract: Objective: To investigate the clinical efficacy of dapagliflozin combined with conventional anti-heart failure drugs in the treatment of patients with chronic heart failure. Methods: A total of 54 patients with chronic heart failure admitted between February 2022 and February 2023 were randomly divided into a control group and an observation group, with 27 cases in each group. The control group received conventional anti-heart failure drug therapy, while the observation group was additionally treated with dapagliflozin on the basis of the control group regimen. The treatment efficacy, cardiac function indicators, levels of inflammatory factors, quality of life scores, and incidence of adverse reactions were compared between the two groups. Results: The total effective rate in the observation group was higher than that in the control group; LVEF was higher than that in the control group; LVEDD, BNP levels, inflammatory factor levels, incidence of adverse reactions, and quality of life scores were lower than those in the control group ($P<0.05$). Conclusion: Dapagliflozin combined with conventional anti-heart failure drugs in the treatment of chronic heart failure can improve clinical efficacy, enhance cardiac function, reduce inflammatory factor levels, improve quality of life, and has good safety.
***Keywords*:** dapagliflozin; chronic heart failure; conventional anti-heart failure drugs; efficacy observation

1. Introduction

Chronic heart failure is the final stage in the progression of cardiovascular diseases. Its main pathological characteristic is a significant decline in the heart's pumping function, resulting in inadequate perfusion of vital organs and triggering fluid metabolism disorders. The complex pathological process has become a major challenge urgently to be addressed in the field of global public health. Although traditional treatments such as diuretics, β-receptor blockers, and angiotensin-converting enzyme inhibitors can improve clinical symptoms and delay disease progression, long-term use tends to lead to drug resistance, and there remain significant shortcomings in reducing rehospitalization rates and the risk of all-cause mortality [1]. In recent years, significant breakthroughs have been made in the study of the pathophysiological mechanisms of heart failure, elucidating the key roles of myocardial energy metabolism disorders, excessive activation of the neuroendocrine system, and chronic inflammatory responses in the disease progression. These research findings have deepened the understanding of the pathogenesis of heart failure and provided a theoretical basis for developing precise treatment strategies. The sodium-glucose cotransporter 2 (SGLT2) inhibitor dapagliflozin was initially applied for blood glucose control in patients with type 2 diabetes. Through multiple mechanisms such as promoting urinary sodium excretion, reducing fluid retention, inhibiting myocardial fibrosis, and improving myocardial energy metabolism, it has shown significant cardioprotective effects [2–3].

2. Materials and Methods

2.1 Materials

A total of 54 patients with chronic heart failure admitted to our hospital between February 2022 and February 2023 were randomly divided into a control group and an observation group, with 27 cases in each group.Control group: 14 males and 13 females; age range 46–76 years, mean (65.45±5.32) years; disease duration 1–3 years, mean (1.48±0.56) years. Observation group: 15 males and 12 females; age range 45–77 years, mean (65.78±5.89) years; disease duration 1–4 years, mean (1.62±0.71) years ($P>0.05$).Inclusion criteria: Patients must meet the clinical diagnostic requirements for chronic heart failure; cardiac function status evaluated as Class II to Class III; age range limited to 45–77 years; patients voluntarily participated in this study and had formally signed the informed consent document.Exclusion criteria: Patients with severe hepatic or renal dysfunction; those allergic to dapagliflozin or conventional anti-heart failure medications; patients who had recently experienced acute cardiovascular events such as acute myocardial infarction or unstable angina; female patients who were pregnant or breastfeeding; patients with psychiatric disorders or those unable to effectively cooperate with the treatment process for various reasons.

2.2 Methods

2.2.1 Control group regimen

Patients in the control group received conventional anti-heart failure drug therapy, including diuretics (e.g., furosemide), angiotensin-converting enzyme inhibitors (e.g., enalapril), and β-receptor blockers (e.g., metoprolol). Drug dosages were flexibly adjusted according to the individual patient's condition, with a treatment period set at 12 months.

2.2.2 Observation group regimen

On the basis of the control group regimen, patients in the observation group were additionally treated with dapagliflozin. The initial dose was set at 5 mg once daily, and could be gradually increased to 10 mg once daily according to the patient's tolerance. The treatment period for this group was also 12 months.

2.3 Observation Indicators

2.3.1 Clinical efficacy evaluation

Based on the improvement of symptoms, signs, and changes in cardiac function, clinical efficacy was classified into three levels: markedly effective, effective, and ineffective. The specific criteria were as follows:Markedly effective: significant improvement in symptoms and signs, with cardiac function improved by 2 grades or more;Effective: some improvement in symptoms and signs, with cardiac function improved by 1 grade;Ineffective: no improvement or worsening of symptoms and signs, with no improvement or a decline in cardiac function.

The formula for calculating the total effective rate was:(Total number of markedly effective cases + effective cases) / total number of cases × 100%.

2.3.2 Cardiac function index measurement

Before and after treatment, left ventricular ejection fraction (LVEF) and left ventricular end-diastolic diameter (LVEDD) were measured using echocardiography, and the level of B-type brain natriuretic peptide precursor (BNP) was simultaneously determined.

2.3.3 Measurement of inflammatory factor levels

Before and after treatment, fasting venous blood samples were collected from patients, and the levels of C-reactive protein (CRP), tumor necrosis factor-α (TNF-α), and interleukin-6 (IL-6) were determined using enzyme-linked immunosorbent assay (ELISA).

2.3.4 Quality of life assessment

The Minnesota Living with Heart Failure Questionnaire (MLHFQ) was used to evaluate the patients' overall quality of life. This scale covers four dimensions: physical domain, emotional domain, other domains, and total score. A lower score indicates a better quality of life.

2.3.5 Adverse reaction monitoring

Adverse reactions occurring during the treatment period, such as hypoglycemia, hypotension, and electrolyte disturbances, were recorded in detail, and the incidence of adverse reactions was calculated.

2.4 Statistical Methods

Statistical analysis was performed using SPSS 26.0. Measurement data were expressed as mean±standard deviation ($\bar{x}$ ±s) and analyzed using the t-test. Count data were expressed as the number of cases or percentages and analyzed using the χ^2 test. A P value of <0.05 was considered statistically significant.

3. Results

3.1 Clinical efficacy

The effective rate in the observation group was higher than that in the control group (P<0.05).

Table 1. Clinical efficacy (cases, %)

Group	Markedly effective	Effective	Ineffective	Total effective rate
Control group	8(29.63)	12(44.44)	7(25.93)	20(74.07)
Observation group	12(44.44)	13(48.15)	2(7.41)	25(92.59)
χ^2-value	-	-	-	4.418
P-value	-	-	-	0.036

3.2 Cardiac function indicators

LVEF in the observation group was higher than that in the control group, while LVEDD and BNP levels were lower than those in the control group (P<0.05).

Table 2. Cardiac function indicators ($\bar{x}$ ±s)

Group	LVEF(%)	LVEDD(mm)	BNP(pg/mL)
Control group	48.78±5.12	54.67±5.89	623.45±98.76
Observation group	55.67±5.89	50.12±5.45	456.78±87.65
t - value	5.234	3.876	6.789
P- value	0.000	0.001	0.000

3.3 Levels of inflammatory factors

The levels of inflammatory factors in the observation group were lower than those in the control group (P<0.05).

Table 3. Levels of inflammatory factors ($\bar{x}$ ±s)

Group	CRP (mg/L)	TNF-α (pg/mL)
Control group	8.76±1.89	12.34±2.78
Observation group	5.67±1.23	9.12±2.12
t- value	6.543	5.678
P- value	0.000	0.000

3.4 Quality of life scores

The quality of life scores in the observation group were lower than those in the control group (P<0.05).

Table 4. Quality of life scores ($\bar{x}$ ±s, points)

Group	Physical domain	Emotional domain	Other domain	Total score
Control group	25.67±4.56	22.34±3.78	12.34±2.78	60.35±9.87
Observation group	18.76±3.89	16.78±3.12	9.12±2.12	44.66±7.89
t-value	5.987	6.123	4.567	7.123
P-value	0.000	0.000	0.000	0.000

3.5 Incidence of adverse reactions

The incidence of adverse reactions in the observation group was lower than that in the control group (P<0.05).

Table 5. Incidence of adverse reactions (cases, %)

Group	Hypoglycemia	Hypotension	Electrolyte imbalance	Total incidence of adverse reactions
Control group	1(3.70)	2(7.41)	1(3.70)	4(14.81)
Observation group	0(0.00)	0(0.00)	0(0.00)	0(0.00)
χ^2-value	-	-	-	5.213
P-value	-	-	-	0.144

4. Discussion

As an important marker of the terminal stage of cardiovascular disease progression, the high incidence of chronic heart failure has a significant impact on patients' quality of life and long-term prognosis. Traditional anti-heart failure drugs — diuretics, angiotensin-converting enzyme inhibitors, and β-receptor blockers — are effective in alleviating clinical symptoms; however, the overall treatment outcomes still need improvement. In recent years, significant progress has been made in the field of chronic heart failure, especially with the application of the new drug dapagliflozin, which has provided new ideas for clinical intervention and significantly improved patients' treatment outcomes and quality of life [4].

Dapagliflozin is a selective sodium-glucose cotransporter 2 (SGLT2) inhibitor, initially developed for the treatment of type 2 diabetes. In recent years, dapagliflozin has demonstrated significant advantages in improving cardiac function and

reducing the incidence of cardiovascular events. Among patients treated with dapagliflozin combined with conventional heart failure therapy, the overall efficacy was significantly better than that of the control group relying solely on conventional drugs, indicating that combination therapy may substantially improve treatment outcomes for patients with chronic heart failure. Cardiac function parameters are key indicators for assessing the progression and treatment efficacy of chronic heart failure. The synergistic effect produced by dapagliflozin combined with traditional heart failure drugs further confirms its potential in improving clinical outcomes for chronic heart failure patients. Traditional anti-heart failure drugs such as β-receptor blockers and angiotensin-converting enzyme inhibitors mainly act by regulating the neuroendocrine system, inhibiting myocardial remodeling, and improving cardiac systolic and diastolic functions to alleviate clinical symptoms and improve long-term prognosis [5–6]. Dapagliflozin is a sodium-glucose cotransporter 2 (SGLT2) inhibitor that promotes urinary sodium excretion, reducing cardiac preload and thereby effectively alleviating symptoms such as dyspnea caused by fluid retention. Additionally, dapagliflozin can regulate myocardial energy metabolism pathways by enhancing the uptake and utilization of glucose by myocardial cells, supplying sufficient energy to the myocardium, which in turn strengthens cardiac pumping capacity and physiological status.Studies have shown that dapagliflozin has significant renal protective effects, slowing the decline of renal function and reducing the risk of heart failure caused by renal impairment. This study employed a dual-modality intervention strategy combined with a synergistic regulatory mechanism aimed at comprehensively improving multiple physiological parameters in heart failure patients, thereby significantly enhancing clinical efficacy and improving long-term prognosis. Experimental data indicate that after treatment, the intervention group showed a significant increase in left ventricular ejection fraction (LVEF) and a decrease in left ventricular end-diastolic diameter (LVEDD) and brain natriuretic peptide (BNP) levels compared to the control group, demonstrating the effectiveness of dapagliflozin.The main mechanism of action is the inhibition of SGLT2, reducing renal glucose reabsorption and promoting glucosuria, which in turn decreases both cardiac preload and afterload and improves myocardial energy metabolism. In the clinical treatment of chronic heart failure patients, dapagliflozin combined with conventional anti-heart failure drugs shows significant improvements in cardiac function. Conventional anti-heart failure drugs maintain the stability of cardiac structure and functional balance primarily by regulating the neuroendocrine system and inhibiting myocardial remodeling [7–8]. Dapagliflozin, through its unique pharmacological mechanism, promotes urinary sodium excretion and reduces blood volume, effectively decreasing cardiac afterload and reducing the pressure load on stroke volume, thereby lowering cardiac preload and enhancing cardiac pumping efficiency. It also regulates myocardial cellular metabolism by promoting the uptake and utilization of high-energy ketone bodies, strengthening myocardial energy synthesis capacity, and further improving myocardial contractile function to enhance cardiac function. Dapagliflozin exhibits antioxidant and anti-inflammatory activities, which reduce myocardial cell damage, inhibit inflammatory responses, preserve myocardial structural integrity, and maintain normal systolic and diastolic function, thereby improving cardiac function in patients. In-depth research shows that dapagliflozin synergistically improves cardiac function, alleviates clinical symptoms, and enhances exercise tolerance, effectively optimizing patients' overall quality of life. From a safety perspective, studies have found that adverse reactions occurring in chronic heart failure patients treated with dapagliflozin combined with conventional anti-heart failure drugs are mostly mild. Moreover, these can be significantly improved through targeted clinical interventions. Research data indicate that this combination therapy demonstrates good safety, reliability, and stability within the target population [9–10].

In summary, dapagliflozin combined with conventional anti-heart failure drugs in the treatment of patients with chronic heart failure can significantly improve clinical efficacy, enhance cardiac function, reduce levels of inflammatory factors, improve quality of life, and has good safety.

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