ORIGINAL RESEARCH

A Comparative Analysis of the Clinical Efficacy of Sacubitril Valsartan Sodium and Enalapril in Patients with Non-Valvular Ejection Fraction Reduction in Heart Failure

Qinqqing Zhang, MM; Jiao Wang, MM; Yingxiao Da, MM; Xin Li, BM; Lei Pan, BM

ABSTRACT

Objective • Heart failure is a common cardiovascular disease, and its prevalence is increasing year by year. For patients with heart failure combined with non-valvular reduced ejection fraction, drug therapy has always been a key treatment. This study aimed to explore the clinical efficacy of sacubitril valsartan sodium and enalapril in such patients.

Methods • Study design: This study used a prospective observational design. From February 2020 to February 2022, we included 123 patients with non-valvular heart failure and reduced ejection fraction who were treated in Xingtai Third Hospital. Patients were divided into two groups according to the treatment plan: Group A (n=61) received enalapril, and Group B (n=62) received nifedipine. All patients received conventional treatment. We compared the efficacy of the two groups of patients 8 weeks after treatment. During the study, the laboratory indicators, echocardiographic indicators, cardiovascular markers, and possible adverse reactions of the two groups of patients before and after treatment were recorded.

Results • After 8 weeks of treatment, the effective rate of group B was higher than group A ($P < .05$). There were no differences in the levels of total protein, total bilirubin, total cholesterol and serum creatinine between the two groups before and after treatment ($P > .05$). The serum creatinine level in the two groups after treatment was higher than that before treatment, and the level in group B was lower than that in group A ($P < .05$). There were no statistically significant differences in the levels of total protein, total bilirubin and total cholesterol between the two groups before and after treatment ($P > .05$), and there was no statistically significant difference in the level of serum creatinine between the two groups before treatment ($P > .05$), and the level of serum creatinine after treatment was higher than that before treatment, and the level of group B was lower than that of group A ($P < .05$). Before treatment, there was no significant difference in the levels of high-sensitive troponin T and n-terminal brain natriuretic peptide and cyclic guanosine phosphate between the two groups ($P > .05$). After treatment, the levels of high-sensitive troponin T and N-terminal brain natriuretic peptide in the two groups were lower than those before treatment, and those in group B were lower than those in group A. The level of cyclic guanosine phosphate in group A was lower than that before treatment, the level of cyclic guanosine phosphate in group B was higher than that before treatment, and the level of group B was higher than that of group A ($P < .05$). The incidence of adverse cardiovascular events in group B was lower than that in group A ($P < .05$).

In this study, the effective rate of treatment group B was significantly higher than that of treatment group A, indicating that treatment group B had a better therapeutic effect. In addition, there were no significant differences between the two groups in a series of biochemical parameters, but it is worth noting that after treatment, the serum creatinine level of group B was significantly lower than that of group A, which may indicate that the treatment of group B is not only more effective but also Reduces the risk of certain adverse cardiovascular events.

Conclusion • The main findings of the study showed that Sacubitril valsartan sodium showed better clinical efficacy than enalapril in patients with heart failure and non-valvular reduced ejection fraction. Specifically, the drug significantly improved patients' kidney function, reduced cardiovascular marker levels, and reduced the incidence of adverse cardiovascular events. These findings have important clinical implications for guiding treatment selection in patients with heart failure. (*Altern Ther Health Med.* 2024;30(10):250-256).

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INTRODUCTION

Heart failure (HF) is a serious cardiovascular disease that seriously affects patients' quality of life and physical and mental health.[1-3] Research shows that the number of heart failure patients in China exceeds 12 million, and the incidence is still increasing.[4,5] Heart failure with nonvalvular reduced ejection fraction (HFrEF) is a common type of HF. It is a group of clinical syndromes caused by reduced ventricular ejection fraction caused by various reasons, resulting in the heart's inability to effectively pump blood. Enalapril is one of the main drugs in the treatment of HFrEF. It helps reduce the burden on the heart and improve the blood supply to the heart by inhibiting the activity of angiotensin-converting enzyme (ACE).[6,7] However, it easily causes a series of side effects, such as cough and electrolyte imbalance, so its clinical application has certain limitations. Sacubitril-valsartan sodium is a co-crystal composed of neprilysin (NEP) inhibitors and anti-angiotensin receptors (ARBs). It not only inhibits the activity of neprilysin and increases plasma Brain natriuretic peptide levels can also lower blood pressure, inhibit myocardial remodeling, and improve patient prognosis. Many studies have shown that sacubitril/valsartan

Table 1. Comparison of general information between the two groups [±s, n/(%)]

Group	Age(y)	Gender		BMI (kg/m²)	Hypertensive	Duration of heart failure (months)	Diabetes
		Male	Female				
Group A (n = 61)	45.26±5.56	35(57.38)	26(42.62)	22.46±2.55	12(19.67)	36.46±11.26	15(24.59)
Group B (n = 62)	46.11±6.79	32(51.61)	30(48.39)	22.13±2.13	15(24.19)	33.59±12.04	16(25.81)
χ^2/t	-0.759	0.412		0.779	0.367	1.365	0.024
P value	0.449	.521		.437	.545	.175	.877
Group	History of smoking	Cardiac Function Classification				Beta-blocker	Diuretic
		Level II		Level III	Level IV		
Group A (n = 61)	26(42.62)	11(18.03)		32(52.46)	18(29.51)	42(68.85)	46(75.41)
Group B (n = 62)	27(43.55)	13(20.97)		33(53.23)	16(25.81)	45(72.58)	44(70.97)
χ^2	0.011	0.292				0.206	0.309
P value	.917	.864				.650	.578

sodium is superior to enalapril in the treatment of HFrEF.[8] However, some studies have shown no significant difference between sacubitril/valsartan and ACE inhibitors in the treatment of patients with heart failure.[9,10] Therefore, this study aimed to investigate the clinical efficacy of sacubitril-valsartan sodium and enalapril in patients with HFrEF.

MATERIALS AND METHODS

General information

123 cases of non-valvular heart failure patients with reduced ejection fraction who were also treated in Xingtai Third Hospital from February 2020 to February 2022 were selected for inclusion in the study and were randomly divided into two groups, and both groups of patients were treated with conventional treatment, and patients in Group A (n=61) were treated with enalapril, and patients in Group B (n=62) were treated with sarcoplasmic valdecoxib sodium, and the general data of the patients in the two groups were collected, and the differences were not statistically significant ($P > .05$), see Table 1. Randomization was achieved using computer-generated random numbers. To generate random numbers, the research team uses a computer generator or specialized statistical software. This ensures the unbiasedness and randomness of the random numbers. For example, you can use a random number generation function in a computer programming language, such as the random library in Python or the sample function in the R language. The purpose of randomization is to ensure that each participant has an equal opportunity to be assigned to a different treatment group to reduce bias and increase the internal validity of the study. The study had a double-blind design, even though group assignment information was unknown to both researchers and patients. This helps reduce subjective bias and improves the internal validity of the results. Blinding is critical to minimizing bias and ensuring the validity of the results, especially when subjective assessments are involved. This study has been approved by the Ethics Committee of Xingtai Third Hospital(Ethical approval number: 202002LL-010). Participants first received face-to-face interviews, and researchers provided detailed research information. They then signed a written informed consent form confirming their understanding and voluntary participation. Researchers emphasize protecting privacy and providing ongoing communication and information updates. We took a series of key steps in ensuring that research participants fully understood and consented to participate. First, we detail the potential risks and benefits to ensure patients have a clear understanding of possible adverse effects of treatment and the possible benefits of the study. The informed consent form clearly outlines the purpose, design, and procedures of the study, emphasizing that participation is voluntary and that patients may opt out at any time without penalty. The approach to privacy and confidentiality is also clearly stated. The patient confirms that he understands the information provided and voluntarily agrees to participate in the study to ensure that his decision to participate is informed and voluntary.

Inclusion criteria: (1) patients' clinical diagnosis meets the relevant diagnostic criteria in the "China Heart Failure Diagnostic and Treatment Guidelines" and is confirmed by imaging examination; (2) patients' age is over 18 years old; (3) patients' NYHA cardiac function classification is II-IV; (4) left ventricular ejection fraction is less than 40%; (5) patients have not received major cardiac surgery three months prior to the enrolment.

Exclusion criteria: (1) patients with congenital heart disease; (2) patients with other serious heart diseases, such as restrictive cardiomyopathy, constrictive pericarditis, acute myocarditis, and pulmonary heart disease.The decision to exclude patients with congenital heart disease was based on the specific purpose of the study and scientific justification. Congenital heart disease may involve different physiological and pathological mechanisms, which may differ from those in patients with non-congenital heart disease; (3) patients with serious liver and kidney injuries; (4) acute and chronic infectious diseases within 3 months of enrollment; (5) missing clinical data, unable to conduct the study. Providing the rationale behind these criteria can help clarify the selection of the study sample and ensure the validity of the data.

Methods

All subjects were given the necessary digitalis, diuretics, β-blockers, sodium-glucose co-transporter protein 2 (SGLT2) inhibitors and other conventional anti-heart failure drug therapy. In group A, enalapril (Sinopharm H20094153, Jiangsu Kangyuan Pharmaceutical Co., Ltd.) was added on the basis of conventional treatment, 5mg/time, 2 times/d, orally; group B was treated with sacubitril valsartan sodium (State Drug Permit J20171054, Beijing Novartis Pharmaceutical Co., Ltd.) on the basis of conventional treatment, with a starting dose of 25 mg/times, 2 times/d, orally, and gradually increased to the target dose of 200 mg/times, 2 times/d, according to the patient's tolerance level. Treatment regimens for both groups (enalapril and sacubitril/valsartan sodium) were well defined. However, it is worth noting that when increasing the dose of sacubitril-valsartan sodium, we followed the principle of patient tolerance level. Specific guidelines and dose adjustment strategies will help provide a more detailed treatment plan for clinical use. Practice provides more instructive information.

Observation indexes

(1) Evaluate the therapeutic effect of the patients after 8 weeks of treatment. The evaluation criteria of the therapeutic effect are as follows: to classify the cardiac function of the patients on the day of admission, and to evaluate the patients again after 8 weeks of treatment, and to consider the clinical symptoms of the patients with heart failure have been significantly controlled and that the cardiac function of the patients' grading has been improved by two grades or more as obvious effect; the patients' clinical symptoms were effectively controlled, and the patient's cardiac function classification was improved by at least one grade as effective; the patients' clinical symptoms were greatly improved, but the patient's cardiac function classification was not significantly improved, and even the condition deteriorated as the treatment was invalid. The treatment efficiency of the patients was calculated: the ratio of the sum of the number of effective cases to the total number of cases, expressed as a percentage.

(2) Record the laboratory index levels of the two groups of patients before and after 8 weeks of treatment, including the total protein, total bilirubin, total cholesterol, and blood creatinine levels.

(3) Echocardiography was performed on the patients before and after 8 weeks of treatment, and the ultrasound indexes of the patients before and after treatment were recorded, including the patients' left ventricular ejection fraction, left atrial internal diameter and left ventricular end-diastolic diameter.

(4) Record the differences in the levels of high-sensitivity troponin T, N-terminal brain natriuretic peptide precursor, and cyclic guanosine monophosphate in patients before and after 8 weeks of treatment.

(5) The occurrence of adverse cardiovascular events, including class II-IV heart failure, cardiac transplantation candidacy, death, and addition of other anti-heart failure medications, was recorded during the treatment period in both groups, and the total incidence rate was calculated.

This clear definition and evaluation method helps ensure the scientificity and reproducibility of research and improve clinical work efficiency.

Statistical analysis

Statistical Product and Service Solutions (SPSS) 23.0 software (IBM, Armonk, NY, USA) was used for data processing, counting data such as the treatment effect of patient patients, gender, cardiac function grading, the occurrence of adverse reactions, etc. were expressed as (n/%), all of which were subjected to the chi-square test; metrics such as cardiac function indexes, cardiovascular markers, and laboratory indexes, etc. were expressed as (±s), and the independent samples *t* test was carried out for the inter-group comparison, and the paired *t*-test was carried out for the intra-group comparison. α=0.05 was the test level. The comparison of research results includes the following aspects: First, compare the efficacy of the two groups. Secondly, biochemical indicators were compared. In addition, cardiac function indicators were compared.

In view of the large number of outcome indicators compared in the study, it is recommended to clarify whether multiple comparisons have been corrected to control type I error. Multiple comparisons may increase the chance of chance results, so correction will help ensure the reliability and statistical significance of the study results. Additional information in this regard will increase readers' confidence in the study design and interpretation of results.

Additionally, cardiovascular marker levels were compared. Finally, the occurrence of adverse cardiovascular events was compared. Additionally, we will employ appropriate data visualization methods such as box plots, scatter plots, and histograms to better present the distribution and relationships of the data. These statistical analyzes will help us identify associations between variables, determine any potential differences, and evaluate the role of laboratory and echocardiographic data in the study.

RESULTS

The results of the study showed that in treatment group B compared with treatment group A, patients' cardiac function improved, cardiovascular marker levels decreased, and the overall incidence of adverse events was lower. These results are clinically important. First, improvements in cardiac function are often associated with improvements in the patient's overall quality of life, including reduced symptoms, increased exercise tolerance, and improved general health. Second, reduced cardiovascular marker levels may reflect better stability of the cardiovascular system, thereby reducing the risk of cardiovascular events. Finally, the reduction in overall adverse event rates meant that treatment arm B experienced fewer heart failure-related adverse events during treatment, further demonstrating the efficacy of sacubitril/valsartan relative to enalapril in the treatment of patients with HFrEF. Advantage.

However, it is worth noting that this study has several limitations. First, the sample size was relatively small, which may have limited accurate assessment of potential effects. Secondly, the study design was a prospective observational study, and the influence of other potential factors on the results cannot be ruled out. In addition, individual patient differences and treatment compliance in clinical practice may also affect the interpretation of study results. Despite these limitations, the results of this study provide useful insights into the use of sacubitril-valsartan sodium in the treatment of HFrEF. Future studies can further validate these findings by enlarging sample sizes, employing more rigorous study designs, and considering more intervention factors.

Comparison of the efficacy of the two groups

After 8 weeks of treatment, the effective rate of group B was higher than that of group A ($P < .05$). Table 2, Figure 1. For treatment group A (n=61), 6 patients (9.84% of the total number) showed significant efficacy, 35 patients (12.90% of the total number) showed some efficacy, and 20 patients (9.84% of the total number) showed some efficacy. 32.79% of

Table 2. Comparison of efficacy between the two groups (n/%)

Group	Effective	Effective	Ineffective	Effective rate
Group A (n = 61)	6 (9.84)	35 (12.90)	20 (32.79)	41 (67.21)
Group B (n = 62)	8 (12.90)	44 (70.97)	10 (16.13)	52 (83.87)
χ^2				4.627
P value				.031

Figure 1. Comparison of efficacy between the two groups

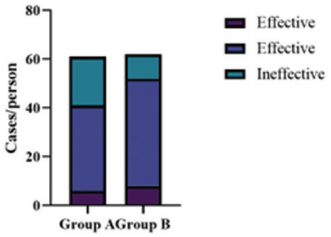

Table 3. Comparison of total protein, total bilirubin, total cholesterol and blood creatinine levels before and after treatment between the two groups of patients (±s)

Group	Total protein (g/L)		Total bilirubin (umol/L)		Total cholesterol (mmol/L)		Blood creatinine (ug/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A (n = 61)	65.55±8.79	64.23±8.77	23.33±12.26	23.44±7.02	3.88±0.98	3.81±0.77	86.66±11.02	101.23±8.45[a]
Group B (n = 62)	64.98±9.11	65.45±8.89	23.16±11.02	23.02±8.15	3.67±1.15	3.85±0.78	86.45±13.02	91.05±7.45[a]
t	0.353	-0.766	0.081	0.306	1.089	-0.286	0.096	7.090
P value	.725	.445	.936	.760	.278	.775	.923	.000

[a]is the comparison with the same group before treatment, $P < .05$

Figure 2. Comparison of total protein, total bilirubin, total cholesterol and blood creatinine levels before and after treatment between the two groups of patients

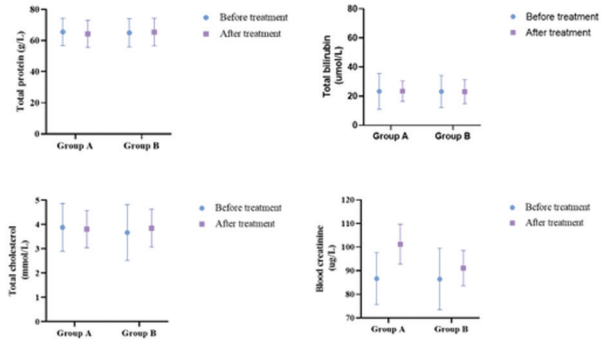

Table 4. Comparison of cardiac function indexes between two groups of patients (±s)

Group	Left ventricular ejection fraction (%)		Left ventricular end-diastolic internal diameter (mm)		Left atrial internal diameter (mm)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A (n = 61)	33.78±4.12	43.56±5.12[a]	65.48±4.19	58.16±5.49[a]	37.77±4.89	36.88±4.89
Group B (n = 62)	33.46±3.89	52.16±4.88[a]	64.98±5.11	55.15±3.16[a]	37.21±3.79	36.46±4.78
t	0.443	-9.537	0.593	3.734	0.711	0.482
P value	.659	.000	.554	.000	.479	.631

[a]is the comparison with the same group before treatment, $P < .05$

the total number) did not show obvious efficacy. Therefore, the overall effective rate of treatment group A was 67.21%. In contrast, 8 patients (12.90% of the total number) in treatment group B (n=62) showed significant efficacy, 44 patients (70.97% of the total number) showed certain efficacy, and 10 patients (accounting for 16.13% of the total number) did not show obvious efficacy. The overall effective rate of treatment group B was 83.87%. Comparison through chi-square test showed that there was a significant difference in the effective rate between treatment groups (χ^2=4.627, P = .031). This shows that treatment group B performs better in terms of overall effectiveness, and compared with treatment group A, the difference is statistically significant.

Comparison of total protein, total bilirubin, total cholesterol and blood creatinine levels before and after treatment between the two groups of patients

There was no statistical difference in the intra-group and inter-group comparisons of total protein, total bilirubin and total cholesterol before and after treatment between the two groups of patients (P > .05), and there was no statistically significant difference in the comparison of blood creatinine levels between the two groups before treatment (P > .05), and the blood creatinine levels after treatment were higher than those before treatment, and Group B was lower than that in Group A (P < .05). Table 3, Figure 2. There were no significant changes in total protein, total bilirubin, and total cholesterol levels in the two groups of patients before and after treatment, indicating that treatment would not have an impact on these biochemical indicators. However, the serum creatinine level increased significantly after treatment, and group B was significantly lower than that of group A, which may be related to the more effective treatment regimen of group B.

Comparison of cardiac function indexes between two groups of patients

The differences in left ventricular ejection fraction left ventricular end-diastolic internal diameter and left atrial internal diameter between the two groups before treatment were not statistically significant (P > .05), and compared with the same group before treatment, the left ventricular ejection fraction of the two groups after treatment was increased and the left ventricular end-diastolic internal diameter was decreased (P < .05), and the differences in the left atrial internal diameter of the two groups before and after treatment were not statistically significant in the comparison between the groups and between the groups (P > .05). Before treatment, there were no significant differences in left ventricular ejection fraction, left ventricular end-diastolic diameter, and left atrial diameter between the two groups. However, after treatment, the left ventricular ejection fraction increased and left ventricular end-diastolic diameter decreased in both groups, which may mean the treatment helped improve heart function. Table 4, Figure 3.

Comparison of cardiovascular marker levels between the two groups of patients

Before treatment, there was no statistically significant difference in the levels of high-sensitivity troponin T, N-terminal brain natriuretic peptide precursor and cyclic guanosine phosphate between the two groups of patients ($P > .05$). After treatment, high-sensitivity troponin T and N-terminal brain natriuretic peptide precursor of the two groups of patients were reduced compared with the pre-treatment period, and group B was lower than group A. The level of cyclic guanosine phosphate in group A was reduced compared with the pre-treatment period. The level of cyclic guanosine phosphate in group B was elevated compared with the pre-treatment period, and group B was higher than group A ($P < .05$). Before treatment, there were no significant differences in the levels of high-sensitivity troponin T, N-terminal pro-brain natriuretic peptide, and cyclic guanosine monophosphate between the two groups of patients. However, after treatment, the levels of high-sensitivity troponin T and N-terminal pro-brain natriuretic peptide decreased, and group B was significantly lower than group A. The level of cyclic guanosine monophosphate decreased in group A and increased in group B, and group B was significantly higher than group A. These changes may reflect the positive effects of treatment on cardiovascular marker levels. Table 5, Figure 4.

Comparison of the occurrence of adverse cardiovascular events between the two groups of patients

In treatment group A (n=61), 4 patients (6.56% of the total) were diagnosed with class II-IV heart failure, and 8 patients (13.11% of the total) were readmitted for heart failure. Three patients (4.92% of the total) became heart transplant candidates, two patients (3.28% of the total) died, and four patients (6.56% of the total) required the addition of other heart failure medications. Therefore, the overall incidence rate in treatment group A was 34.43%. In contrast, in treatment group B (n=62), 1 patient (1.61% of the total) was diagnosed with class II-IV heart failure, and 4 patients (6.45% of the total) developed heart failure. Failure was readmitted, 2 patients (3.23% of the total) became heart transplant candidates, 1 patient (1.61% of the total) died, and 3 patients (4.84% of the total) needed to be added Heart failure medications. The overall incidence rate in treatment group B was 17.74%. The chi-square test showed that there was a significant difference in the overall incidence rate between treatment groups (χ^2=2.268, $P = .035$). This shows that treatment group B has a lower incidence of adverse events than treatment group A in terms of various indicators. Table 6.

Figure 3. Comparison of cardiac function indexes between two groups of patients

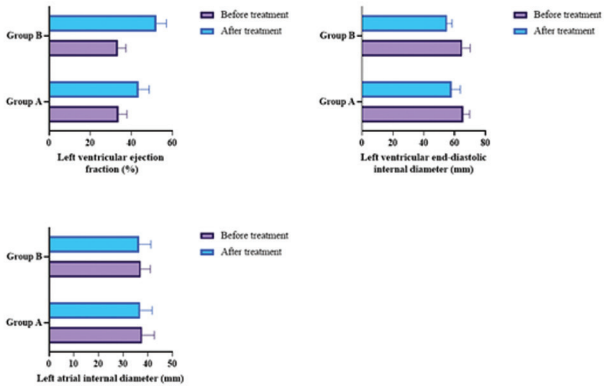

Table 5. Comparison of cardiovascular marker levels between the two groups of patients (±s)

Group	High-sensitivity troponin T (ng/L)		N-terminal brain natriuretic peptide precursor (pg/ml)		Cyclic guanosine phosphate (nmol/L)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A (n = 61)	30.33±4.26	21.66±3.46[a]	2760.15±339.15	1917.26±35.44[a]	698.15±65.02	622.46±26.48[a]
Group B (n = 62)	31.44±6.16	19.22±1.02[a]	2832.16±322.44	1301.14±31.02[a]	718.26±65.15	992.46±21.15[a]
t	-1.161	5.323	-1.207	102.641	-1.713	-85.695
P value	.248	.000	.230	.000	.089	.000

[a]is the comparison with the same group before treatment, $P < .05$

Figure 4. Comparison of cardiovascular marker levels between the two groups of patients

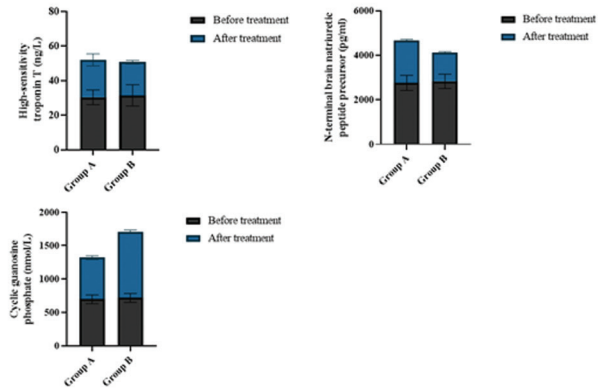

Table 6. Comparison of adverse cardiovascular events between the two groups (n/%)

Group	Class II-IV Heart Failure	Heart Failure Readmission	Heart transplant candidate	Death	Addition of other heart failure drugs	Overall incidence
Group A (n = 61)	4 (6.56)	8 (13.11)	3 (4.92)	2 (3.28)	4 (6.56)	21 (34.43)
Group B (n = 62)	1 (1.61)	4 (6.45)	2 (3.23)	1 (1.61)	3 (4.84)	11 (17.74)
χ^2						2.268
P value						.035

DISCUSSION

Mechanism

The mechanism of action of sacubitril, valsartan sodium and enalapril on heart failure is the key focus of this study. Enalapril reduces cardiac load by inhibiting excessive activation of the RAAS system, while sacubitril valsartan not only inhibits AngII receptor activity, but also contains sacubitril, a neprilysin inhibitor, which improves diuresis by slowing down the degradation of natriuretic peptides in the body.[11] The level of natriuretic peptide helps to dilate blood vessels, reduce cardiac load, reduce front and rear load, delay the progression of heart failure, thereby improving the

prognosis of patients.[12] The results of the study showed that after the treatment period, the left ventricular ejection fraction of the two groups of patients increased and the left ventricular end-diastolic diameter decreased, and the effective rate of treatment group B was higher than that of treatment group A, indicating that sacubitril valsartan sodium.[13-14] It has better clinical efficacy in patients with HFrEF. This is consistent with the research results of Xu Ding et al., further confirming the superiority of sacubitril valsartan. [15] In addition, by increasing the level of natriuretic peptides in the body, sacubitril valsartan plays a role in the production of cyclic guanosine monophosphate, thereby reducing the burden on the heart and improving the patient's cardiac function by promoting blood vessel relaxation and inhibiting the reabsorption of sodium by the renal tubules.

Clinical efficacy

The clinical implications of the findings are another aspect of our focus. Improvements in cardiac and renal function are not only closely related to the patient's overall quality of life, but also to alleviating symptoms, improving exercise tolerance, and reducing the risk of cardiovascular events.[16] Treatment group B showed greater improvement in cardiac function, improvement in renal function, and reduction in cardiovascular marker levels after treatment, which may translate into better patient outcomes and quality of life.[17] The study results also showed that treatment group B had a lower incidence of adverse cardiovascular events than treatment group A, highlighting the potential benefit of sacubitril valsartan sodium in reducing adverse cardiovascular events. This is consistent with the results of other studies, indicating that compared with enalapril, sacubitril valsartan can reduce the burden on the heart and improve cardiac function, while also having the advantage of inhibiting the inflammatory response and delaying the progression of heart failure.[18]

Comparison with previous studies

It is necessary to compare the results of this study with the previous studies mentioned in the introduction. This helps highlight consistencies or differences across studies and discuss potential reasons that may account for these differences. The consistency of the study results can provide stronger support for the effectiveness of sacubitril valsartan in the treatment of HFrEF and provide a background for further research. At the same time, discussion of any differences can help better understand the heterogeneity between studies and prompt future research to delve deeper into the reasons for these differences.

Limitations

Transparency about the limitations of a study is an essential component of scientific research. The relatively small sample size of this study may affect the generalizability and statistical power of the results, so a larger study may help confirm these findings. Additionally, no control group was used in the study, which may lead to a degree of uncertainty about the results. In future studies, introducing a control group may help improve the internal validity of the study. In addition, the selection of study participants may be affected by individual factors, which may bias the results to a certain extent. These factors require more in-depth consideration to determine their potential impact on the results. Other factors that may affect the results, such as treatment compliance, external factors during the study, etc., should also be considered.

Future research

This study provides some directions for future research. For example, further studies could confirm the safety of sacubitril-valsartan in patients with severe renal impairment and delve into long-term outcomes or effects in specific patient subgroups. Individualized treatment strategies for patients with heart failure and the combination of sacubitril valsartan with other anti-heart failure drugs also deserve further study. These studies will contribute to a more comprehensive understanding of the effects of sacubitril valsartan in different patient groups and provide more targeted treatment options for clinical practice.

Clinical significance

Overall, the results of this study highlight the favorable clinical efficacy of sacubitril valsartan in patients with HFrEF, including improvements in cardiac and renal function, as well as positive effects on cardiovascular marker levels. These results provide important guidance for clinicians when selecting treatment options. When considering treatment decisions for patients with heart failure, the superiority of sacubitril valsartan, particularly in improving cardiac function, reducing adverse cardiovascular events, and improving renal function, may make it the preferred treatment option. This has positive practical implications for improving patients' overall health and quality of life.

CONCLUSION

Taken together, the results of this study support the superiority of sacubitril-valsartan sodium in the treatment of patients with HFrEF, especially its performance in improving cardiac function, reducing the risk of cardiovascular events, and improving renal function. However, study limitations require careful consideration when interpreting the results. Future studies should continue to delve into the long-term effects, safety, and applicability of this treatment in diverse patient populations. This will help provide more personalized and effective treatment strategies for heart failure patients.

ETHICAL COMPLIANCE

This study was approved by the ethics committee of Xingtai Third Hospital. Signed written informed consent were obtained from the patients and/or guardians.

CONFLICT OF INTEREST

The authors have no potential conflicts of interest to report relevant to this article.

AUTHOR CONTRIBUTIONS

QZ and XL designed the study and performed the experiments, JW and YD collected the data, JW, YD, and LP analyzed the data, QZ and XL prepared the manuscript. All authors read and approved the final manuscript.

FUNDING
No funding

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