JURNAL ILMU KEFARMASIAN INDONESIA
Indonesian Journal of Pharmaceutical Sciences
ISSN p-ISSN 1693-1831 (Print) e-ISSN 2614-6495 (Online) PUBLISHER : Faculty of Pharmacy Universitas Pancasila

ACE inhibitor–diuretic change on renal function and qol in heart failure patients with hypertension at Tasikmalaya heart hospital

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Received: 24 July 2026 / Accepted: 30 August 2026

ABSTRACT: Hypertension is a major contributor to heart failure and requires effective treatment to prevent clinical deterioration. Combination therapy with an ACE inhibitor and a diuretic is commonly used to control blood pressure and reduce congestive symptoms; however, renal function and quality of life need to be monitored. This study aimed to evaluate changes in renal function, describe quality of life, and analyze the relationship between renal function changes and quality of life in hypertensive patients with heart failure receiving ACE inhibitor and diuretic combination therapy. This observational study used retrospective and cross-sectional approaches. A total of 65 outpatients at Tasikmalaya City Heart Hospital from January to March 2026 were selected using total sampling. Renal function data, including urea, creatinine, and eGFR, were obtained from medical records, while quality of life was assessed using the Minnesota Living with Heart Failure Questionnaire (MLHFQ). The Wilcoxon test showed significant changes in renal function after therapy, indicated by increased creatinine and urea levels and decreased eGFR, with $p<0.05$. Most patients had moderate quality of life, accounting for 60 patients (92%). Correlation analysis showed no significant relationship between changes in creatinine, urea, or eGFR and quality of life. This study indicates that ACE inhibitor and diuretic combination therapy is associated with renal function changes, but these changes are not significantly related to patients' quality of life.

KEYWORDS: ACE inhibitors; diuretics; kidney function; heart failure; quality of life.

▪ INTRODUCTION

Hypertension continues to impose a substantial global health burden and remains a major cause of cardiovascular morbidity and mortality. According to the World Health Organization (2025), approximately 1.28 billion adults aged 30–79 years are affected by hypertension, and most cases remain undiagnosed or inadequately controlled [1]. This condition is of particular concern because hypertension often does not present with specific symptoms and is therefore known as a silent killer. Nevertheless, it can cause damage to target organs including the heart, brain, blood vessels, and kidneys [2]. Hypertension also contributes to more than 10.4 million deaths annually worldwide, making blood pressure control an essential strategy for preventing cardiovascular complications [3].

Heart failure represents one of the most serious consequences of long-standing hypertension. Persistently elevated blood pressure increases the workload placed on the heart, which may induce left ventricular hypertrophy, myocardial structural and functional remodeling, and impaired cardiac contractility [4], [5]. Hypertension approximately doubles the risk of heart failure in men and triples it in women, accounting for an estimated 39% and 59% of cases, respectively [6]. Approximately 64 million people worldwide are affected by heart failure, while in Indonesia, a history of hypertension is present in about 36% of heart failure cases and constitutes a major risk factor [7], [8].

Pharmacological therapy is essential for the effective management of patients with hypertension and heart failure, particularly in controlling blood pressure, reducing fluid accumulation, improving congestive symptoms, and maintaining hemodynamic stability. A regimen combining an angiotensin-converting enzyme inhibitor (ACE inhibitor) with a diuretic is commonly used to treat patients with hypertension and

How to cite this article: Riyanti A, Zain DN, Pebiansyah A. ACE inhibitor–diuretic change on renal function and qol in heart failure patients with hypertension at Tasikmalaya heart hospital. Jurnal Ilmu Kefarmasian Indonesia. 2026. 24(2): 384-392.

https://doi.org/10.35814/jifi.v24i2.2187
ISSN: 2614-6495

heart failure, as it is considered effective in lowering blood pressure, improving congestive symptoms, and reducing the risk of recurrent hospitalization due to cardiac decompensation [9]. ACE inhibitors block the conversion of angiotensin I to angiotensin II, thereby decreasing vasoconstriction and cardiac workload. Diuretics complement these effects by reducing fluid retention, edema, and dyspnea in patients with heart failure [10], [11].

Despite their clinical benefits, the combined use of ACE inhibitors and diuretics still requires safety monitoring, particularly with regard to renal function. ACE inhibitors may affect renal hemodynamics by reducing intraglomerular pressure and renal perfusion, whereas diuretics can decrease effective circulating volume, which may consequently decrease renal blood flow and glomerular filtration rate [12]. These changes may be reflected in increased blood urea and creatinine levels and decreased estimated glomerular filtration rate (eGFR). Consequently, renal function assessment is an essential component of therapeutic monitoring, particularly for patients at risk of renal impairment or those receiving long-term ACE inhibitor–diuretic therapy.

In addition to clinical and laboratory parameters, quality of life represents an important outcome in assessing therapeutic success among patients with heart failure. The World Health Organization describes quality of life as an individual's perception of their position in life within the context of their culture and value systems and in relation to their goals, expectations, standards, and concerns [13]. In patients with heart failure, quality of life may be adversely affected by restricted physical activity, persistent fatigue, dyspnea, anxiety, and difficulty performing daily activities. Disease-specific instruments used to evaluate this outcome include the Kansas City Cardiomyopathy Questionnaire and the Minnesota Living with Heart Failure Questionnaire (MLHFQ) [14].

Evidence regarding the effects of combined ACE inhibitor and diuretic therapy on renal function and QoL in patients with hypertension and HF remains limited, especially in Southeast Asian populations and the Indonesian setting. Although previous studies have indicated that ACE inhibitors may alleviate clinical symptoms in patients with HF, renal responses differ among individuals, and most of the available evidence has been generated in Western populations [15]. Hypertension continues to impose a substantial public health burden in Tasikmalaya City, where an estimated 215,661 cases were recorded in 2023. Nevertheless, local evidence systematically examining the effects of combined ACE inhibitor and diuretic therapy on renal function and QoL in patients with coexisting hypertension and HF remains unavailable [16]. To address this evidence gap, the present study examined changes in renal function and QoL in patients with hypertension and HF and assessed the association between changes in renal function and patients' quality of life.

▪ MATERIALS AND METHODS

Research design and location

This observational study employed a retrospective *cross-sectional* design and was conducted at Tasikmalaya City Heart Hospital, Indonesia, from January to March 2026. A retrospective approach was used to evaluate changes in renal function based on patients' medical records before and after receiving combination therapy with an ACE inhibitor and a diuretic. A *cross-sectional* approach was used to assess patients' QoL at the time of data collection.

Population and sample

The study included outpatients at Tasikmalaya City Heart Hospital with hypertension and heart failure who were receiving an angiotensin-converting enzyme inhibitor (ACE inhibitor) plus a diuretic. Total sampling was used to enroll all eligible patients aged ≥18 years who had complete blood urea, serum creatinine, and estimated glomerular filtration rate (eGFR) data, provided informed consent, and had undergone outpatient treatment for at least two months. Patients who did not meet any of these criteria were excluded, resulting in a final sample of 65 participants.

Quality-of-life assessment

After providing written informed consent, patients completed the Indonesian version of the Minnesota Living with Heart Failure Questionnaire (MLHFQ) in an interview. The instrument measures the impact of heart failure during the previous month using items scored from 0 - 5, with higher scores reflecting a greater impact of heart failure and poorer quality of life. The total MLHFQ scores were categorized as good (0–24), moderate (25–60), or poor (>60). The Indonesian version of the MLHFQ has been reported to demonstrate good validity and reliability among patients with chronic heart failure in Indonesia.

Data collection and renal function assessment

Data collection was conducted from January to March 2026 by reviewing patients' medical records. Medical records from the 2025–2026 period were retrospectively reviewed to identify patients who met the eligibility criteria. The pre-treatment renal function measurement was defined as the most recent complete assessment of blood urea, serum creatinine, and eGFR documented before initiation of ACE inhibitor–diuretic therapy. eGFR values were obtained directly from the patients' medical records as reported by the hospital laboratory. The post-treatment measurement was defined as the subsequent complete renal function assessment documented after initiation of the therapy. The pre-treatment and post-treatment values were compared to assess changes in renal function. After patients were identified as eligible based on the retrospective medical record review, quality of life was assessed once during the study period using the Indonesian version of the Minnesota Living with Heart Failure Questionnaire (MLHFQ).

Statistical analysis

Analyses were performed using IBM SPSS Statistics. Descriptive statistics summarized patient, treatment, renal function, and quality-of-life data, with categorical variables reported as frequencies and percentages. Because the Shapiro–Wilk test indicated non-normal renal function changes, pre- and post-treatment blood urea, serum creatinine, and eGFR were compared using the Wilcoxon signed-rank test. Spearman's rank correlation assessed the associations with quality of life, with $p<0.05$ considered significant.

Ethical considerations

Ethical approval was obtained from the Health Research Ethics Committee of BTH University, Tasikmalaya (approval No. 112-01/E.01/KEPK-BTH/IV/2026). Patient information was handled confidentially and use exclusively for research purposes. Before participating in the quality-of-life assessment, each patient provided a written informed consent.

▪ RESULTS

Patient characteristics

A total of 65 patients with hypertension and heart failure who received combination therapy with an ACE inhibitor and a diuretic met the study eligibility criteria. Most patients were male, comprising 35 patients (53.8%). Patients older than 60 years constituted the largest age group, with 32 patients (49%), followed by those aged 41–60 years, with 30 patients (46%). The complete patient characteristics are presented in Table 1.

Table 1. Characteristics of patients with hypertension and heart failure.

Characteristics	Category	Frequency (n=65)	Percentage (%)
Sex	Male	35	53.8
	Female	30	46.2
Age group	18–40 years	3	4.6
	41–60 years	30	46.2
	>60 years	32	49.2
Occupation	Retired	1	1.5
	Civil servant/military/police	3	4.6
	Entrepreneur	2	3.1
	Trader	27	41.5
	Private employee	6	9.2
	Laborer	2	3.1
	Housewife	21	32.3
	Unemployed	3	4.6
Education	Elementary school	26	40.0
	Junior high school	17	26.2
	Senior/vocational high school	18	27.7
	Bachelor's degree	4	6.2
Smoking history	Yes	33	50.8
	No	32	49.2

Combination therapy utilization profile

The predominant treatment regimen combined an ACE inhibitor with an aldosterone antagonist diuretic and was prescribed to 31 patients (48%). An additional 25 patients (38%) received an ACE inhibitor aldosterone antagonist, and loop diuretic. The distribution of combination therapy use is show in Table 2.

Table 2. Distribution of combination therapy use.

Therapy regimen	Frequency (n=65)	Percentage (%)
ACE inhibitor + thiazide diuretic	1	1.5
ACE inhibitor + loop diuretic	7	10.8
ACE inhibitor + aldosterone antagonist diuretic	31	47.7
ACE inhibitor + aldosterone antagonist diuretic + loop diuretic	25	38.5
ACE inhibitor + aldosterone antagonist diuretic + loop diuretic + thiazide diuretic	1	1.5

Renal function

Changes in renal function parameters

Following combination therapy with an ACE inhibitor and a diuretic, serum creatinine levels increased in 43 patients (66.2%), while 22 patients (33.8%) showed a decrease. Blood urea levels increased in 49 patients (75.4%) and decreased in 16 patients (24.6%). For eGFR, 17 patients (26.2%) showed an increase, 43 patients (66.2%) showed a decrease, and 5 patients (7.7%) showed no change.

The Shapiro–Wilk test indicated that the changes in serum creatinine, blood urea, and eGFR were not normally distributed (all $p<0.001$). Therefore, differences in renal function parameters before and after therapy were evaluated using the Wilcoxon signed-rank test. Serum creatinine levels showed a significant difference ($p=0.002$), blood urea ($p<0.001$), and eGFR ($p=0.002$). The findings are presented in Table 3.

Table 3. Changes in renal function parameters following combination therapy.

Renal function parameter	Pre-treatment, Median (IQR)	Post-treatment, Median (IQR)	Increased, n (%)	Decreased, n (%)	Unchanged, n (%)	p-value
Serum creatinine (mg/dL)	1.02 (0.77–1.15)	0.99 (0.82–1.23)	43 (66.2)	22 (33.8)	0 (0.0)	0.002
Urea (mg/dL)	24.6 (19.3–38.4)	29.4 (23.3–40.7)	49 (75.4)	16 (24.6)	0 (0.0)	<0.001
eGFR (mL/min/1.73 m²)	76 (65–95)	75 (63–90)	17 (26.2)	43 (66.2)	5 (7.7)	0.002

Note: Data are presented as median (interquartile range [IQR]) and number (percentage). Comparisons between pre-treatment and post-treatment values were performed using the Wilcoxon signed-rank test. A p-value <0.05 was considered statistically significant.

Patient quality of life

MLHFQ scores classified 60 patients (92%) as having moderate QoL, four (6%) as having good QoL, and one (2%) as having poor QoL. The distribution of patients' quality-of-life categories is presented in Table 4.

Table 4. Distribution of patients' quality of life based on MLHFQ scores.

Quality-of-life category	Frequency (n=65)	Percentage (%)
Good	4	6
Moderate	60	92
Poor	1	2

Note: MLHFQ, Minnesota Living with Heart Failure Questionnaire.

Association between changes in renal function and quality of life

Spearman analysis revealed no significant correlations between MLHFQ scores and changes in serum creatinine (r=−0.114; p=0.368), blood urea (r=0.147; p=0.243), or eGFR (r=0.084; p=0.505). All correlation coefficients indicated very weak associations between the variable. The results of the analysis are presented in Table 5.

Table 5. Association between changes in renal function and quality of life.

Variable	Correlation coefficient (*r*)	*p*-value	Interpretation
Change in serum creatinine and MLHFQ score	−0.114	0.368	Not significant
Change in blood urea and MLHFQ score	0.147	0.243	Not significant
Change in eGFR and MLHFQ score	0.084	0.505	Not significant

Note: Data were analyzed using Spearman's rank correlation. significant p<0.05.

▪ DISCUSSION

The analysis revealed significant changes in renal function following combined ACE inhibitor and diuretic therapy, characterized by increased serum creatinine and blood urea levels and a reduced eGFR. However, these changes in renal function were not significantly associated with patients' quality of life. These findings suggest that renal function and quality of life represent two distinct outcome dimensions. Renal function parameters objectively reflect physiological changes, whereas the MLHFQ assesses the impact of heart failure on patients' quality of life, including the physical, emotional, and social aspects of their daily lives.

The patient characteristics in this study showed that most participants were older than 60 years of age. This finding indicates that heart failure is more commonly observed among older adults, consistent with the progressively increase prevalence of this condition in this age group [17]. Age-related structural and functional cardiovascular changes, increased vascular stiffness, and a higher comorbidity burden may collectively increase the risk of heart failure and progressive renal impairment. Furthermore, the modest predominance of male participants may indicate that heart failure occurs more frequently in men, although

the observed sex differences could also reflect variations in age and the characteristics of the study population [18].

Most patients in this study had low to moderate educational attainment. Educational level plays an important role in patients' ability to understand information about their disease, medication use, symptom monitoring, and the importance of treatment adherence. Lower educational attainment is often associated with limited comprehension of medical instructions, which may ultimately influence treatment adherence and patients' quality of life [19]. Furthermore, a relatively large proportion of patients in this study had a history of smoking. Smoking may impair vascular function, promote oxidative stress, while accelerating cardiovascular disease progression, and smokers face a greater risk of heart failure than nonsmokers [20].

The most commonly used treatment regimen was the combination of an ACE-inhibitor and an aldosterone antagonist diuretic. This prescribing pattern aims to suppress Renin-Angiotensin-Aldosterone System (RAAS) activity while limiting sodium retention and excess fluid accumulation in patients with HF. ACE inhibitors reduce angiotensin II formation, thereby decreasing vasoconstriction and fluid retention, whereas aldosterone antagonists, such as spironolactone, reduce sodium and water retention. The combination of these two drug classes may produce synergistic effects by reducing congestion and decreasing cardiac workload [21]. In patients with HF and reduced ejection fraction, aldosterone antagonist therapy has demonstrated clinical benefits by reducing morbidity, mortality, and rehospitalization rates [22]. Nevertheless, concurrent administration of an ACE-i and an aldosterone antagonist necessitates routine monitoring of renal function and electrolyte levels because both agents influence the RAAS.

The post-treatment rise in Scr and blood urea, together with the reduction in eGFR, may be attributed to the hemodynamic effects of ACE inhibitors on glomerular function. ACE inhibitors decrease angiotensin II production, which plays an important role in maintaining efferent arteriolar vasoconstriction. Reduced angiotensin II levels lead to efferent arteriolar vasodilation, decreased intraglomerular pressure, and a subsequent reduction in eGFR [23]. This decline in filtration capacity may result in increased serum creatinine and blood urea levels and reduced eGFR. Therefore, an increase in serum creatinine following ACE inhibitor therapy does not necessarily indicate structural kidney damage but may instead reflect a functional change caused by reduced intraglomerular pressure.

Concomitant diuretic use may also contribute to changes in renal function. Diuretics promote sodium and fluid excretion to relieve congestion; however, excessive diuresis may reduce intravascular volume and renal perfusion. The combination of ACE–induced efferent arteriolar vasodilation and diuretic-induced reductions in circulating volume may increase the likelihood of decreased eGFR and elevated serum creatinine and blood urea levels. These results align with earlier studies showing that ACE inhibitor therapy in patients with heart failure may affect serum creatinine and urea levels, both of which are commonly used as indicators of renal function [24]. These findings further support the evidence that combination antihypertensive therapy may influence renal function through alterations in patients' hemodynamic status [25]. Renal responses to therapy may vary among patients. The kidneys' ability to maintain the glomerular filtration rate may be influenced by age, clinical condition, comorbidities, and hydration status [26]. In addition, changes in serum creatinine, blood urea, and eGFR may also be affected by baseline renal function, blood pressure, heart failure severity, medication dose and duration, and the intensity of diuresis.

According to the MLHFQ, most patients were classified as having a moderate quality of life. This finding indicates that patients continued to experience limitations in daily activities and emotional well-being due to heart failure despite receiving treatment. Heart failure is a chronic, progressive disorder commonly characterized by dyspnea, fatigue, edema, sleep disturbances, and restricted physical activity. Ongoing symptoms and reduced capacity for physical activity are key contributors to diminished QoL in patients with HF [27]. Furthermore, the combined physical and emotional symptom burden is significantly associated with higher MLHFQ scores, reflecting poorer QoL among patients [28]. The high proportion of patients with moderate quality of life may be attributable to the chronic and progressive course of heart failure. Fatigue is commonly experienced by patients with this condition, dyspnea, reduced exercise tolerance, sleep disturbances, anxiety, and limitations in daily activities. These symptoms may persist despite pharmacological treatment, particularly because disease severity, comorbidities, functional capacity, and treatment adherence vary among patients. Heart failure management is intended to relieve symptoms, improve functional performance and QoL, and lower the risks of hospitalization and mortality [29], [30]. Nevertheless, in clinical practice, patients may continue to experience impaired quality of life despite receiving therapy in accordance with established heart failure management principles.

The results indicated no statistically significant association between changes in renal function parameters and QoL in patients with HTN and HF. Correlation analyses of changes in serum creatinine, blood urea, and eGFR yielded coefficients that were all classified as very weak, indicating no direct association with MLHFQ scores. These findings do not imply that renal function is clinically unimportant; rather, they indicate that laboratory indicators of renal function and patients' perceived quality of life constitute separate dimensions of clinical outcomes. QoL in patients with HF encompasses multiple dimensions, as it is shaped by interactions among physical health, functional capacity, symptom burden, psychological well-being, and social support. In these patients, quality of life primarily reflects the extent to which symptoms, functional limitations, and emotional burden affect their ability to perform daily activities [30]. Symptom severity, functional class, activity capacity, and the frequency of hospitalization have also been recognized as key determinants of QoL [31]. Psychological factors, particularly anxiety and depression, may have a considerable impact on QoL, potentially exceeding the effects of certain clinical parameters [32].

Changes in serum creatinine, blood urea, or eGFR remain important for monitoring treatment safety and therapeutic response; however, these changes may not necessarily be perceived directly by patients as a decline in quality of life, particularly when they are not accompanied by worsening symptoms, increased congestion, reduced functional capacity, or hospitalization. In contrast, QoL is more substantially affected by underlying conditions that patients experience directly, such as dyspnea, fatigue, activity limitations, and their psychological and social well-being [30]. Thus, objective changes in renal function do not always correspond directly to patients' subjective perceptions of their health status. QoL among patients with chronic HF is likely influenced by the interplay among disease severity, activity tolerance, comorbidities, treatment adherence, psychological well-being, and social support. Therefore, it may not be significantly associated with changes in any single laboratory parameter considered in isolation [33].

Combination therapy with an ACE inhibitor and a diuretic may produce different clinical responses simultaneously. Reduced fluid retention may alleviate dyspnea and edema and improve activity tolerance, thereby supporting improvements in patients' quality of life. Conversely, therapy-induced hemodynamic changes may affect serum creatinine, blood urea, and eGFR levels. The concomitant use of ACE-i and diuretics has been associated with symptom relief, improved activity tolerance, and reduced hospitalization risk among patients with chronic HF [34]. This may explain why changes in renal function are not always accompanied by changes in quality of life in the same direction. Therefore, renal function monitoring and quality-of-life assessment should be regarded as distinct but complementary components of clinical evaluation. Measurements of serum creatinine, blood urea, and eGFR are necessary to assess treatment safety and detect physiological changes, whereas quality-of-life assessment is needed to evaluate the effects of the disease and its treatment on symptoms, daily activities, and patient well-being. An approach that integrates both types of outcomes may provide a more comprehensive understanding of treatment effectiveness and safety among patients with coexisting HT and HF.

▪ CONCLUSION

Among patients with coexisting hypertension and heart failure, ACE inhibitor–diuretic combination therapy was associated with changes in renal function, characterized by increased serum creatinine and blood urea levels and decreased eGFR. Most patients were classified as having a moderate quality of life, with no significant association observed between quality of life and changes in renal function parameters. These findings indicate that renal function changes were observed following therapy, but a direct association between renal function changes and quality of life could not be established. Renal function and quality of life represent distinct yet complementary clinical outcomes. Therefore, serum creatinine, blood urea, eGFR, and quality of life should be considered together when evaluating treatment safety and patient outcomes. Further prospective studies with larger cohorts and longer follow-up are needed to evaluate the influence of treatment duration, dosage, baseline renal function, heart failure severity, comorbid conditions, and psychosocial factors on these outcomes.

▪ LIMITATIONS

This study has several limitations. **First,** renal function was assessed retrospectively by comparing the available pre-treatment and post-treatment measurements, whereas quality of life was assessed once during

the study period using the MLHFQ. The dates of the renal function measurements were not recorded; therefore, the exact interval between the pre-treatment and post-treatment measurements and between the post-treatment renal function assessment and the MLHFQ assessment could not be determined. Consequently, the correlation between changes in renal function and MLHFQ scores presented in Table 5 should be interpreted cautiously, as the two assessments may not represent the same clinical time point. **Second,** the absence of a control group limits the ability to determine whether the observed changes in renal function were attributable solely to ACE inhibitor–diuretic therapy. Other factors, including the underlying heart failure condition and cardiorenal interactions, may also have contributed to the observed changes. In addition, treatment-related factors, including treatment duration, dose, and dose changes, were not available as analytical variables in the present study. Other clinical factors, such as hydration status and comorbid conditions, were also not analyzed because they were beyond the predefined scope of the study. Therefore, their potential influence on changes in renal function could not be separately assessed. **Finally,** the distribution of quality-of-life scores was highly concentrated in the moderate category, with 60 of 65 patients (92%) classified as having moderate quality of life. This limited variability in MLHFQ scores may have reduced the ability to detect an association between changes in renal function and quality of life. Further studies with a larger sample size, a control group, and broader assessment of treatment-related and clinical factors are needed to confirm and further explain these findings.

Acknowledgements: -

Funding: -

Conflict of interest statement: The authors declare no conflicts of interest.

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