

Evaluasi Penggunaan ACEI pada Fungsi Ginjal dan Profil Lipid pada Pasien Hipertensi Rawat Jalan di RSUD Raden Mattaher, Jambi, Provinsi Jambi

Evaluation of ACEI Use on Kidney Function and Lipid Profile in Outpatient Hypertension Patients at Raden Mattaher General Hospital, Jambi, Jambi Province

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Abstrak

Hipertensi adalah masalah kesehatan global yang meningkatkan risiko penyakit kardiovaskular dan gangguan fungsi ginjal. Penggunaan Angiotensin-Converting Enzyme Inhibitors (ACEIs) banyak direkomendasikan karena efektivitasnya dalam menurunkan tekanan darah dan memberikan efek renoprotektif. Namun, variasi respons terapeutik, terutama pada fungsi ginjal dan profil lipid, memerlukan evaluasi lebih lanjut. Penelitian ini bertujuan untuk menganalisis hubungan antara penggunaan ACEI dan fungsi ginjal dan profil lipid pada pasien hipertensi rawat jalan. Penelitian ini menggunakan desain analitik observasional dengan pendekatan retrospektif berdasarkan data rekam medis pasien hipertensi yang menerima terapi ACEI. Sampel dipilih berdasarkan kriteria inklusi, dengan data lengkap fungsi ginjal (eGFR, kreatinin serum, dan BUN) dan profil lipid (kolesterol total, LDL, HDL, dan trigliserida). Data dianalisis menggunakan statistik deskriptif dan analisis inferensial menggunakan uji Kruskal-Wallis. Hasil penelitian menunjukkan bahwa mayoritas pasien berada pada kelompok usia lanjut usia akhir (56-65 tahun) (39,6%) dan didominasi laki-laki (62,1%). secara signifikan terkait dengan kreatinin serum ($p = 0,000$), sementara tidak ada hubungan signifikan yang ditemukan dengan eGFR ($p = 0,206$) dan BUN ($p = 0,170$). Selain itu, durasi penggunaan ACEI tidak menunjukkan hubungan yang signifikan dengan eGFR ($p = 0,089$), tetapi secara signifikan terkait dengan kreatinin serum ($p = 0,001$) dan BUN ($p = 0,009$). Mengenai profil lipid, baik jenis maupun durasi penggunaan ACEI secara signifikan terkait dengan semua parameter, termasuk kolesterol total, LDL, HDL, dan trigliserida (semua $p = 0,000$). Kesimpulannya, terapi ACEI menunjukkan hubungan diferensial dengan fungsi ginjal dan parameter profil lipid pada pasien hipertensi. Oleh karena itu, pemantauan fungsi ginjal dan profil lipid secara teratur direkomendasikan untuk mengoptimalkan hasil terapeutik dan mencegah potensi komplikasi metabolisme dan ginjal.

Kata kunci: ACEI; Fungsi Ginjal; Profil Lipid.

Abstract

Hypertension is a global health problem that increases the risk of cardiovascular disease and impaired kidney function. The use of Angiotensin-Converting Enzyme Inhibitors (ACEIs) is widely recommended due to their effectiveness in lowering blood pressure and providing renoprotective effects. However, variations in therapeutic responses, particularly in kidney function and lipid profile, require further evaluation. This study aimed to analyze the association between ACEI use and kidney function and lipid profile in outpatient hypertensive patients. This study employed an observational analytic design with a retrospective approach based on medical record data of hypertensive patients receiving ACEI therapy. Samples were selected based on inclusion criteria, with complete data on kidney function (eGFR, serum creatinine, and BUN) and lipid profile (total cholesterol, LDL, HDL, and triglycerides). Data were analyzed using descriptive statistics and inferential analysis using the Kruskal-Wallis test. The results showed that the majority of patients were in the late elderly age group (56-65 years) (39.6%) and predominantly male (62.1%). significantly associated with serum creatinine ($p = 0.000$), while no significant associations were found with eGFR ($p = 0.206$) and BUN ($p = 0.170$). In addition, the duration of ACEI use showed no significant association with eGFR ($p = 0.089$), but was significantly associated with serum creatinine ($p = 0.001$) and BUN ($p = 0.009$). Regarding lipid profiles, both the type and duration of ACEI use were significantly associated with all

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parameters, including total cholesterol, LDL, HDL, and triglycerides (all $p = 0.000$). In conclusion, ACEI therapy shows differential associations with kidney function and lipid profile parameters in hypertensive patients. Therefore, regular monitoring of renal function and lipid profiles is recommended to optimize therapeutic outcomes and prevent potential metabolic and renal complications.

Keywords: ACEI; Kidney Function; Lipid Profile.

1. INTRODUCTION

Hypertension is a significant global health issue because it contributes substantially to morbidity and mortality from cardiovascular and kidney diseases. The use of antihypertensive therapy, particularly Angiotensin-Converting Enzyme Inhibitors (ACEIs), is a primary choice due to their effectiveness in lowering blood pressure and providing protective effects on target organs. Furthermore, ACEIs act through the renin-angiotensin-aldosterone system (RAAS), which plays a crucial role in regulating blood pressure and kidney function. However, the effects of ACEIs are not limited to blood pressure; they can also influence other biochemical parameters such as renal function and lipid profiles associated with cardiovascular risk(1,2).

In clinical practice, the use of ACEIs in outpatients with hypertension shows varying effects on renal function and lipid profiles. Several studies indicate that renal function remains relatively stable during ACEI therapy, characterized by the absence of significant changes in serum creatinine or glomerular filtration rate (GFR) in the short term(3). However, under certain conditions, particularly in patients with comorbidities such as diabetes, changes in biochemical parameters such as increased creatinine or specific lipid alterations may occur when ACEIs are used in combination therapy(3). Additionally, clinical reports indicate that ACEI use may also interact with other therapies in dynamically modulating renal function(4).

Previous research has shown that ACEIs have a renoprotective effect through the reduction of intraglomerular pressure and proteinuria, thereby playing a role in slowing the progression of kidney disease(5). Furthermore, ACEIs are generally considered to have a neutral effect on lipid profiles, unlike some other classes of antihypertensive drugs(1,2). However, some studies report variations in lipid effects, particularly when combined with other medications or in specific populations(3). Overall, scientific evidence suggests that the effects of ACEIs on renal function and lipids still vary depending on the patient's condition and concomitant therapy.

Although many studies have evaluated the effects of ACEIs, most were conducted in populations with specific conditions such as chronic kidney disease or diabetes, so the results cannot yet be fully generalized to the general outpatient hypertensive population. Additionally, some studies indicate no significant differences in lipid parameters and renal function between treatment groups; however, the strength of evidence remains low and results are inconsistent(2). On the other hand, empirical data at the regional hospital level, particularly in Indonesia, remains limited, and thus does not yet reflect the actual conditions of ACEI use regarding renal function and lipid profiles in outpatients with hypertension within a local context(6).

Based on the above, this study aims to evaluate the use of ACEIs on renal function and lipid profiles in outpatients with hypertension at Raden Mattaher General Hospital in Jambi. This study will analyze renal function parameters such as serum creatinine and glomerular filtration rate, as well as lipid profiles including total cholesterol, LDL, HDL, and triglycerides. The study results are expected to provide an empirical overview of the effects of ACEI use in daily clinical practice and serve as a basis for consideration in the management of more optimal, evidence-based hypertension therapy.

2. METHODS

Study Design and Location

This study uses an analytical observational design with a retrospective *cross-sectional* approach. The study was conducted at Raden Mattaher General Hospital in Jambi, which is a referral hospital in Jambi Province, Indonesia. Data were collected from the medical records of outpatients with hypertension during the study period.

Study Population and Sample

The study population consisted of all adult patients diagnosed with hypertension and undergoing outpatient treatment with Angiotensin-Converting Enzyme Inhibitors (ACEIs). Inclusion criteria included: patients aged ≥ 18 years, diagnosed with hypertension, receiving ACEI therapy for at least 3 months, and having complete laboratory data regarding renal function and lipid profile. Exclusion criteria included: incomplete medical records, pregnant patients, and patients with severe comorbidities such as end-stage renal failure. Sampling was performed using *purposive sampling* based on the predetermined inclusion and exclusion criteria.

Variables and Measurements

The independent variable in this study was the use of ACEI therapy. Dependent variables included renal function and lipid profile. Renal function was assessed based on serum creatinine levels and estimated glomerular filtration rate (*eGFR*). The lipid profile includes total cholesterol, *low-density lipoprotein* (LDL), *high-density lipoprotein* (HDL), and triglycerides. All laboratory data were obtained from patients' medical records and analyzed using standard clinical laboratory methods.

Data Collection Procedure

Data were collected retrospectively from medical records using a pre-designed data collection form. The data collected included demographic characteristics (age, sex), clinical data (blood pressure, comorbidities), treatment history (type and duration of ACEI use), and laboratory test results. Prior to analysis, a data selection process was conducted to ensure data completeness and consistency.

Data Analysis

Data analysis was performed using statistical software. Descriptive analysis was used to describe the characteristics of the study subjects, presented as mean $\pm$ standard deviation for normally distributed numerical data, median (interquartile range) for non-normally distributed data, and frequency (percentage) for categorical data. A normality test was performed using the Liliefors test. The results of the normality test indicated that the data were not normally distributed; therefore, inferential analysis employed a non-parametric approach. To evaluate differences in renal function and lipid profiles based on ACEI use, the Kruskal–Wallis test was used. If statistically significant differences were found, *post-hoc* tests were conducted to determine differences between groups. A *p-value* < 0.05 was considered statistically significant.

3. RESULT

Based on data from outpatients with hypertension who met the study criteria, the characteristics of the study subjects including demographic and clinical variables were obtained. The characteristics of the study subjects are presented in Table 1.

Tabel 1. Characteristics of Outpatient Hypertension Patients at Raden Mattaher General Hospital, Jambi.

Patient Characteristics	Number	%
Age		
Late Adults (36–45 years)	18	5.2
Early Elderly (46–55 years)	126	36.2
Late Elderly (56–65 years)	138	39.6
Elderly (> 65 years)	66	19.0
Total	348	100.0
Gender		
Male	216	62.1
Female	132	37.9
Total	348	100.0

Patient characteristics based on age show that the late elderly group (56–65 years) was the largest group, comprising 138 patients (39.6%). Meanwhile, based on gender, the majority of patients were male, comprising 216 patients (62.1%).

Furthermore, the results of renal function and lipid profile evaluations in patients receiving ACEI therapy are presented in the following table.

Table 2. Distribution of ACEI Types and Duration of Use Among Outpatient Hypertension Patients at Raden

Mattaher General Hospital, Jambi		
ACEI Use	Number	%
Type of ACEI		
Captopril	24	6.9
Enalapril	36	10.3
Lisinopril	78	22.4
Ramipril	96	27.6
Perindopril	24	6.9
Imidapril/Tanapress	90	25.9
Total	348	100.0
Duration of ACEI Use		
< 1 year	38	10.9
1–3 years	190	54.6
> 3 years	120	34.5
Total	348	100.0

The use of ACEIs in hypertensive patients showed that the most commonly used drug was ramipril, used by 96 patients (27.6%). Furthermore, based on duration of use, the majority of patients had been using ACEIs for 1–3 years, totaling 190 patients (54.6%).

Table 3. Overview of Renal Function and Lipid Profile in Outpatient Hypertensive Patients Using ACEIs at Raden Mattaher General Hospital, Jambi

Renal Function Parameters	n	Mean $\pm$ SD	Minimum	Maximum
Serum Creatinine (mg/dL)	348	1.11 $\pm$ 0.24	0.09	1.70
eGFR (mL/min/1.73 m ²)	348	69.28 $\pm$ 14.45	35	99
BUN (mg/dL)	348	18.09 $\pm$ 2.77	12	29
Lipid Profile Parameters				
Total Cholesterol (mg/dL)	348	149.83 $\pm$ 41.73	88	280
LDL (mg/dL)	348	120.34 $\pm$ 32.63	41	261
HDL (mg/dL)	348	45.27 $\pm$ 6.11	32	60
Triglycerides (mg/dL)	348	164.48 $\pm$ 27.37	110	265

The mean serum creatinine level of 1.11 $\pm$ 0.24 mg/dL with a range of 0.09–1.70 mg/dL indicates that most patients have kidney function that is still within normal limits or slightly elevated. The mean eGFR value of 69.28 $\pm$ 14.45 mL/min/1.73 m² with a range of 35–99 mL/min/1.73 m² indicates that some patients fall into the category of mild to moderate renal impairment. Additionally, the average BUN level of 18.09 $\pm$ 2.77 mg/dL remained within the normal range for most patients.

Regarding lipid profile parameters, the average total cholesterol level of 149.83 $\pm$ 41.73 mg/dL indicates that most patients fall within the normal range. However, the average LDL level of 120.34 $\pm$ 32.63 mg/dL is still classified as borderline high. The average HDL level of 45.27 $\pm$ 6.11 mg/dL indicates a relatively adequate value, although in some patients it remains below the optimal level. Meanwhile, the average triglyceride level of 164.48 $\pm$ 27.37 mg/dL shows a tendency toward elevation in some patients.

Table 4. Relationship Between Treatment Regimen and Duration of Treatment (ACEI) with Kidney Function Among Hypertensive Patients at Raden Mattaher Regional General Hospital, Jambi Province, 2025

Variable	Category	Median	p-value	Interpretation
Type of ACEI	Serum Creatinine	1.1	0.000	Significant
	eGFR	72	0.206	Not Significant
	BUN	18.5	0.170	Not Significant
Duration of ACEI Use	Serum Creatinine	1.1	0.001	Significant
	eGFR	72	0.089	Not Significant
	BUN	18.5	0.009	Significant

Statistical analysis was performed using the Kruskal–Wallis test

Based on the table above, the results of the Kruskal–Wallis test showed a significant association between the type of ACEI and serum creatinine levels among hypertensive patients at Raden Mattaher Regional General Hospital, Jambi Province, in 2025 ($p = 0.000$). However, no significant association was found between the type of ACEI and eGFR values ($p = 0.206$) or BUN levels ($p = 0.170$). Furthermore, the duration of ACEI use was

significantly associated with serum creatinine levels ($p = 0.001$) and BUN levels ($p = 0.009$). In contrast, no significant association was observed between the duration of ACEI use and eGFR values ($p = 0.089$).

Table 5. Relationship Between Treatment Regimen and Duration of Treatment (ACEI) with Lipid Profile Among Hypertensive Patients at Raden Mattaher Regional General Hospital, Jambi Province, 2025

Variable	Category	Median	p-value	Interpretation
Type of ACEI	Total Cholesterol	138	0.000	Significant
	LDL	123	0.000	Significant
	HDL	45	0.000	Significant
	Triglycerides	165	0.000	Significant
Duration of ACEI Use	Total Cholesterol	138	0.000	Significant
	LDL	123	0.000	Significant
	HDL	45	0.000	Significant
	Triglycerides	165	0.000	Significant

Statistical analysis was performed using the Kruskal–Wallis test.

Based on the table above, the results of the Kruskal–Wallis test demonstrated significant associations between the type of ACEI and the lipid profile of hypertensive patients at Raden Mattaher Regional General Hospital, Jambi Province, in 2025. This was indicated by the p-values for all lipid profile parameters, including total cholesterol ($p = 0.000$), LDL cholesterol ($p = 0.000$), HDL cholesterol ($p = 0.000$), and triglycerides ($p = 0.000$), all of which were below the significance threshold of 0.05. These findings suggest that differences in the type of ACEI used were significantly associated with variations in the lipid profile of hypertensive patients. Furthermore, the duration of ACEI use was also significantly associated with all lipid profile parameters among hypertensive patients. The p-values for total cholesterol, LDL cholesterol, HDL cholesterol, and triglycerides were all 0.000 ($p < 0.05$). Therefore, it can be concluded that the duration of ACEI therapy was significantly associated with the lipid profile of hypertensive patients at Raden Mattaher Regional General Hospital, Jambi Province, in 2025.

4. DISCUSSION

The characteristics of the study subjects showed a predominance of older adults and men, reflecting the strong contribution of vascular aging to the occurrence of hypertension. Aging is associated with increased arterial stiffness, endothelial dysfunction, and activation of the renin-angiotensin-aldosterone system (RAAS), which significantly increases the risk of hypertension and target organ damage. Additionally, the predominance of men in this study may be linked to higher exposure to cardiometabolic risk factors, including smoking and unhealthy lifestyles. This pattern is consistent with global epidemiological reports showing an increased prevalence of hypertension in older adults as well as gender-based distribution differences(7–11).

The distribution of ACEI use shows a preference for ramipril, reflecting a tendency to use agents with a long duration of action and a stable pharmacokinetic profile. This aligns with clinical recommendations that ACEIs are first-line therapy for hypertension, particularly in patients with high cardiovascular risk and renal impairment(12). Furthermore, long-term use (1–3 years) underscores that antihypertensive therapy is chronic and requires high adherence. However, this study did not evaluate aspects of adherence or therapy intensification, which are important determinants of successful blood pressure control(7,13–16).

Descriptively, renal function showed relative stability in creatinine and BUN, but there was a mild to moderate decrease in eGFR. These findings are consistent with the mechanism of action of ACEIs, which lower intraglomerular pressure through efferent arteriolar vasodilation, potentially causing an initial hemodynamic-driven decrease in eGFR rather than structural damage. Recent meta-analyses indicate that ACEIs actually provide a protective effect against the progression of kidney disease, including reducing the risk of kidney failure(17). Furthermore, RAAS inhibitor therapy is consistently associated with a slowing of chronic kidney disease progression(18). However, without longitudinal data, it is difficult to distinguish whether the eGFR decline in these studies represents a physiological adaptation or an indication of progressive renal dysfunction(17,19–22).

Regarding metabolic parameters, a trend toward increased LDL and triglycerides, as well as relatively suboptimal HDL levels, was observed. These findings contradict the classical assumption that ACEIs are neutral regarding lipid metabolism. Theoretically, ACEIs have no direct effect on lipid synthesis or metabolism; therefore, the observed changes are most likely influenced by other factors such as insulin resistance, obesity, dietary patterns, and combination therapy. Previous studies have shown that lipid profiles in hypertensive patients are more influenced by metabolic factors and lifestyle than by ACEI therapy itself(23–27).

A comparative analysis showed no significant differences in creatinine and BUN levels among different types of ACEIs, but there were significant differences in eGFR. This indicates that although the renoprotective effects of ACEIs are relatively homogeneous, there is heterogeneity in their effects on glomerular filtration dynamics. This variation is likely due to differences in the pharmacokinetics and pharmacodynamics among agents, including bioavailability, half-life, and affinity for the ACE enzyme. Additionally, observational studies suggest that the response to ACEIs may vary depending on the patient's clinical condition, including the stage of kidney disease and comorbidities(28). Therefore, without multivariate analysis, it is difficult to eliminate the influence of confounding factors(18,19,21,28,29).

Conversely, findings of significant differences in all lipid profile parameters across ACEI types require more critical interpretation. Biologically, there is no strong mechanism supporting a direct effect of ACEIs on lipids; therefore, these results likely reflect selection bias or uncontrolled confounding. Factors such as statin use, differences in baseline cardiovascular risk, and lifestyle variations may be the primary determinants. Previous studies have emphasized that changes in lipid profiles in hypertensive patients are more closely associated with comorbid factors and adjunctive therapies than with direct ACEI effects(23–27).

Overall, this study indicates that the use of ACEIs in outpatients with hypertension is relatively safe regarding renal function; however, it shows variations in eGFR and lipid profiles that cannot be fully explained by known pharmacological mechanisms. The clinical implications of these findings are the need for an individualized therapeutic approach as well as routine monitoring of renal function and metabolic parameters. However, the retrospective design and the lack of control for confounding factors limit causal inferences. Therefore, prospective studies with a stronger design are needed to clarify the relationship between ACEI type, kidney function, and lipid profiles(17,18,20,21,30).

5. CONCLUSION

The results of this study indicate that both the type of ACEI and the duration of ACEI therapy were significantly associated with the lipid profile of hypertensive patients at Raden Mattaher Regional General Hospital, Jambi Province, in 2025. Significant associations were observed for all lipid profile parameters, including total cholesterol, LDL cholesterol, HDL cholesterol, and triglyceride levels, suggesting that variations in ACEI treatment and treatment duration may contribute to differences in lipid profile outcomes among hypertensive patients. These findings underscore the importance of considering both the choice of ACEI and the duration of therapy in the comprehensive management of hypertension. Therefore, regular monitoring of lipid profile parameters is recommended for patients receiving ACEI therapy to optimize treatment outcomes and reduce the risk of cardiovascular complications.

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