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Original Research Article

COMPARATIVE ASSESSMENT OF RENAL FUNCTION, ELECTROLYTE ABNORMALITIES, AND BLOOD PRESSURE CONTROL AMONG PATIENTS RECEIVING ACE INHIBITORS VERSUS ANGIOTENSIN RECEPTOR BLOCKERS FOR ESSENTIAL HYPERTENSION

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ABSTRACT

Background: Essential hypertension is a major cardiovascular risk factor requiring effective blood pressure control and preservation of renal function. Angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs) are widely prescribed antihypertensive agents, although differences in renal effects, electrolyte disturbances, and tolerability may influence treatment selection. **Aim:** To compare renal function, electrolyte abnormalities, blood pressure control, and adverse drug effects among patients receiving ACE inhibitors versus ARBs for essential hypertension.

Materials and Methods: This hospital-based observational comparative study included 104 patients with essential hypertension at a tertiary care hospital. Patients were divided into two groups: Group A received ACE inhibitors (n=52), while Group B received ARBs (n=52). Demographic characteristics, blood pressure parameters, serum creatinine, estimated glomerular filtration rate (eGFR), electrolyte levels, and adverse drug effects were assessed. Statistical analysis was performed using IBM SPSS Statistics version 28.0, with $p<0.05$ considered statistically significant.

Results: Mean systolic blood pressure was significantly lower in the ARB group (132.10 ± 12.10 mmHg) than in the ACE inhibitor group (137.80 ± 12.90 mmHg; p=0.022). Adequate blood pressure control was achieved in 76.92% of ARB users compared with 55.77% of ACE inhibitor users (p=0.037). Mean eGFR was 81.80 ± 17.40 and 76.50 ± 18.60 mL/min/1.73 m², respectively (p=0.137). Serum potassium was significantly higher among ACE inhibitor users (4.62 ± 0.48 versus 4.42 ± 0.44 mmol/L; p=0.029). Dry cough occurred in 23.08% and 3.85% of patients, respectively (p=0.008).

Conclusion: ARBs were associated with better observed blood pressure control and fewer cough-related adverse effects than ACE inhibitors. Renal function differences were statistically insignificant. Individualized treatment and regular renal and electrolyte monitoring remain essential.

Keywords: Essential Hypertension; ACE Inhibitors; Angiotensin Receptor Blockers; Renal Function; Electrolyte Abnormalities.

INTRODUCTION

Essential hypertension is one of the most prevalent chronic cardiovascular disorders and represents a major public health concern worldwide. It is characterized by persistently elevated systemic arterial blood pressure without an identifiable secondary cause. The condition develops through complex interactions involving genetic susceptibility, environmental factors, altered vascular resistance, neurohormonal activation, and impaired renal sodium regulation. Persistent

hypertension contributes significantly to cardiovascular morbidity, cerebrovascular disease, chronic kidney disease, and premature mortality. Despite the availability of several effective antihypertensive medications, achieving sustained blood pressure control remains challenging in routine clinical practice. Appropriate selection of antihypertensive therapy is therefore essential for controlling blood pressure and preventing hypertension-mediated organ damage.[1]

The renin–angiotensin–aldosterone system (RAAS) plays a central role in the pathophysiology of essential hypertension by regulating vascular tone, circulating blood volume, sodium balance, and renal haemodynamics. Excessive RAAS activation promotes vasoconstriction, sodium and water retention, endothelial dysfunction, and cardiovascular remodelling. Pharmacological inhibition of this system is an established therapeutic strategy for hypertension management. Angiotensin-converting enzyme inhibitors (ACE inhibitors) and angiotensin receptor blockers (ARBs) are widely prescribed because of their antihypertensive properties and potential cardiovascular and renal benefits. Both drug classes modify RAAS activity through different mechanisms, making their comparative effectiveness and safety important considerations in individualized treatment selection.[2]

ACE inhibitors, including enalapril, ramipril, and lisinopril, primarily act by inhibiting the conversion of angiotensin I into angiotensin II, thereby reducing vasoconstriction and aldosterone secretion. They also decrease bradykinin degradation, which contributes to vasodilatation but may produce certain adverse effects. In contrast, ARBs such as losartan, telmisartan, and olmesartan selectively block angiotensin II type 1 receptors, preventing angiotensin II-mediated vasoconstriction and aldosterone release without directly inhibiting bradykinin breakdown. Both classes are recommended as important therapeutic options for hypertension. However, differences in pharmacological mechanisms, drug tolerability, and individual responses may influence clinical decision-making.[3]

Blood pressure control remains the primary objective of antihypertensive therapy, as sustained elevation of systolic and diastolic pressure increases the risk of target-organ complications. Clinical assessment commonly includes systolic blood pressure, diastolic blood pressure, mean arterial pressure, and achievement of recommended treatment targets. Although ACE inhibitors and ARBs act on the same hormonal system, variations in drug pharmacokinetics, receptor activity, duration of action, and patient characteristics may influence their effectiveness. Treatment adherence, associated comorbidities, and concomitant antihypertensive medications also contribute to observed blood pressure control. Comparative evaluation of both classes under routine clinical conditions is therefore necessary to support rational prescribing practices.[4]

Renal function represents another essential consideration during antihypertensive treatment because the kidneys are both regulators of blood pressure and important targets of hypertension-mediated injury. Long-standing hypertension may produce renal vascular changes, glomerular damage, albuminuria, and progressive impairment of filtration capacity. ACE inhibitors and ARBs influence intraglomerular haemodynamics by reducing angiotensin II-mediated efferent arteriolar constriction. Although this mechanism can provide long-term renoprotective effects, it may also produce haemodynamic changes in serum creatinine and estimated glomerular filtration rate (eGFR). Assessment of serum creatinine, blood urea nitrogen, serum urea, eGFR, and urinary albumin excretion is therefore important for evaluating renal status and ensuring treatment safety.[5]

The relationship between hypertension, diabetes mellitus, and renal dysfunction further increases the importance of appropriate antihypertensive drug selection. Patients with coexisting metabolic disorders frequently demonstrate endothelial dysfunction, altered renal haemodynamics, and increased susceptibility to progressive kidney injury. RAAS inhibitors are particularly relevant in hypertensive patients with albuminuria because of their effects on glomerular pressure and urinary protein excretion. Nevertheless, the therapeutic response may vary according to baseline kidney function, diabetic status, medication dosage, and associated cardiovascular risk factors. Monitoring renal parameters and albuminuria during treatment is essential for identifying clinically important abnormalities and assessing the suitability of continuing therapy.[6]

Electrolyte disturbances represent important safety concerns associated with RAAS inhibition, particularly alterations in serum potassium concentration. Suppression of aldosterone activity can reduce renal potassium excretion, thereby increasing susceptibility to hyperkalaemia. This complication is especially relevant among patients with impaired renal function, diabetes mellitus, advanced age, or concomitant medications affecting potassium regulation. Additional electrolyte parameters, including serum sodium, chloride, and bicarbonate, may provide useful information regarding overall biochemical status and renal electrolyte handling. Regular monitoring is necessary to detect abnormalities and prevent potentially serious complications. Comparative assessment of electrolyte profiles among ACE inhibitor and ARB users may help identify treatment-related safety concerns.[7]

MATERIALS AND METHODS

The present study was designed as a hospital-based observational comparative study conducted at a tertiary care hospital to evaluate and compare renal function, electrolyte abnormalities, and blood pressure control among patients receiving angiotensin-converting enzyme inhibitors (ACE inhibitors) and angiotensin receptor blockers (ARBs) for essential hypertension. A total of 104 patients diagnosed with essential hypertension were included in the study. Patients were divided into two groups according to their prescribed antihypertensive medications. Group A comprised 52 patients receiving ACE inhibitors, while Group B comprised 52 patients receiving ARBs. The study assessed the comparative clinical profiles, renal function parameters, serum electrolyte levels, and effectiveness of blood pressure control in both treatment groups. Patients attending the outpatient and inpatient departments of General Medicine with an established diagnosis of essential hypertension were considered eligible. Participants were selected using a consecutive sampling technique according to predefined inclusion and exclusion criteria. Patients receiving ACE inhibitors or ARBs as part of their antihypertensive treatment for at least three months were included to ensure adequate drug exposure. The prescribed medications included commonly used ACE inhibitors, such as enalapril, ramipril, and lisinopril, and ARBs, such as telmisartan, losartan, and olmesartan. Patients were assigned to the respective groups based on their existing prescriptions without modifying their treatment for research purposes.

Inclusion Criteria

Patients aged 18 years and above with a confirmed diagnosis of essential hypertension who were receiving either ACE inhibitors or ARBs were included. Patients with stable antihypertensive treatment, available clinical records, and willingness to participate were considered eligible. Both male and female patients were included irrespective of hypertension severity, provided they fulfilled the eligibility criteria.

Exclusion Criteria

Patients with secondary hypertension, acute kidney injury, advanced chronic kidney disease with an estimated glomerular filtration rate (eGFR) below 30 mL/min/1.73 m^2, renal artery stenosis, severe hepatic dysfunction, or decompensated heart failure were excluded. Patients receiving combined ACE inhibitor and ARB therapy, potassium supplements, or potassium-sparing diuretics were excluded. Pregnant women, patients with severe electrolyte disturbances requiring emergency intervention, and those with incomplete clinical or laboratory records were also excluded.

Methodology

Detailed clinical histories were recorded using a structured study proforma. Demographic variables included age, sex, residential background, educational status, and socioeconomic status. Clinical parameters included duration of hypertension, family history of hypertension, smoking, alcohol consumption, physical activity, body mass index (BMI), and associated comorbidities such as diabetes mellitus, dyslipidaemia, and cardiovascular disease. Information regarding antihypertensive drug type, dosage, medication adherence, and concomitant medications was documented. Height and weight were measured, and BMI was calculated as weight in kilograms divided by height in metres squared.

Blood Pressure Assessment

Blood pressure was measured using a calibrated automated sphygmomanometer following standardized procedures. Patients were instructed to remain seated comfortably for at least five minutes before measurement. Two blood pressure readings were obtained at an interval of one to two minutes, and the average was considered for analysis. Systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and pulse pressure were recorded. MAP was calculated as DBP + one-third of pulse pressure. For the purpose of comparison, controlled hypertension was defined as SBP below 140 mmHg and DBP below 90 mmHg. The proportion of patients achieving blood pressure control was compared between the two groups.

Assessment of Renal Function

Renal function was evaluated using serum creatinine, blood urea nitrogen (BUN), serum urea, and eGFR. Venous blood samples were collected under aseptic precautions and analysed using standard laboratory methods. Serum creatinine was measured using a validated laboratory assay, and eGFR was calculated using the 2021 Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) creatinine equation. Patients were categorized according to eGFR levels of ≥90, 60–89, 30–59, and below 30 mL/min/1.73 m^2, with the last category excluded according to eligibility criteria. Reduced kidney function was defined as eGFR below 60 mL/min/1.73 m^2. Urinary albumin-to-creatinine ratio (UACR) was also assessed, wherever available, to evaluate albuminuria and renal involvement.

Assessment of Electrolyte Abnormalities

Serum sodium, potassium, chloride, and bicarbonate levels were assessed using standard biochemical methods. Particular emphasis was placed on serum potassium because of its clinical association with renin–angiotensin–aldosterone system blockade. Hyperkalaemia was defined as serum potassium above 5.0 mmol/L, while hypokalaemia was defined as below 3.5 mmol/L. Hyponatraemia was defined as serum sodium below 135 mmol/L, and hypernatraemia as above 145 mmol/L. The frequency and severity of electrolyte abnormalities were compared between both treatment groups.

Assessment of Adverse Drug Effects

Drug-related adverse effects were documented through clinical history and available medical records. Particular attention was given to dry cough, dizziness, symptomatic hypotension, hyperkalaemia, and renal function abnormalities. The occurrence of adverse effects was compared between patients receiving ACE inhibitors and ARBs to evaluate their comparative tolerability and safety profiles.

Outcome Measures

The primary outcome measures were differences in serum creatinine, eGFR, serum potassium, and systolic and diastolic blood pressure between the two treatment groups. Secondary outcomes included the prevalence of electrolyte abnormalities, reduced kidney function, albuminuria, achievement of blood pressure control, and frequency of drug-related adverse effects. Potential associations between clinical characteristics, treatment groups, and renal or electrolyte abnormalities were also evaluated.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 28.0. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on data distribution. Categorical variables were presented as frequencies and percentages. The Shapiro–Wilk test was used to assess normality. The independent samples t-test or Mann–Whitney U test was applied for continuous variables, while the Chi-square test or Fisher's exact test was used for categorical variables. Multivariable linear or logistic regression analysis was planned, where appropriate, to adjust for potential confounding factors such as age, sex, diabetes mellitus, baseline renal function, and concomitant antihypertensive medications. A p-value below 0.05 was considered statistically significant.

RESULTS

Table 1: Comparison of Demographic and Baseline Clinical Characteristics Between ACE Inhibitor and ARB Groups (N=104)

Table 1 presents the demographic and baseline clinical characteristics of 104 patients, equally distributed between the ACE inhibitor and ARB groups, with 52 patients in each group. The mean age was 53.80 ± 10.70 years in the ACE inhibitor group and 54.40 ± 11.20 years in the ARB group (p=0.781). Male patients constituted 57.69% and 55.77% of the respective groups, while females accounted for 42.31% and 44.23%. Rural residents predominated in both groups, comprising 59.62% and 63.46%, respectively (p=0.840). The mean duration of hypertension was 6.80 ± 3.90 years among ACE inhibitor users compared with 7.00 ± 4.10 years among ARB users (p=0.799), while the corresponding mean BMI values were 27.60 ± 3.70 and 27.80 ± 3.50 kg/m² (p=0.778). Diabetes mellitus was present in 34.62% and 38.46% of patients, dyslipidaemia in 48.08% and 51.92%, and smoking history in 23.08% and 21.15%, respectively. No statistically significant differences were observed in the assessed baseline demographic and clinical characteristics between the two groups (p>0.05).

Table 2: Comparison of Blood Pressure Parameters and Blood Pressure Control Between ACE Inhibitor and ARB Groups (N=104)

Table 2 illustrates the comparison of blood pressure parameters and hypertension control between patients receiving ACE inhibitors and ARBs. The mean systolic blood pressure was significantly higher in the ACE inhibitor group (137.80 ± 12.90 mmHg) than in the ARB group (132.10 ± 12.10 mmHg), with a statistically significant difference (p=0.022). Similarly, mean diastolic blood pressure was 86.40 ± 8.80 mmHg among ACE inhibitor users compared with 82.80 ± 8.20 mmHg among ARB users (p=0.033). Mean arterial pressure was significantly lower in the ARB group (99.20 ± 9.00 mmHg) than in the ACE inhibitor group (103.50 ± 9.50 mmHg; p=0.020). Although pulse pressure was slightly lower among ARB users (49.30 ± 8.70 mmHg) compared with ACE inhibitor users (51.40 ± 9.20 mmHg), the difference was statistically insignificant (p=0.235). Adequate blood pressure control was observed in 76.92% of patients receiving ARBs compared with 55.77% receiving ACE inhibitors, demonstrating a statistically significant difference (p=0.037). Conversely, uncontrolled blood pressure was observed in 44.23% of ACE inhibitor users and 23.08% of ARB users, indicating better observed blood pressure control in the ARB group.

Table 3: Comparison of Renal Function Parameters Between ACE Inhibitor and ARB Groups (N=104)

Table 3 demonstrates the comparative assessment of renal function parameters among patients receiving ACE inhibitors and ARBs. The mean serum creatinine level was 1.13 ± 0.25 mg/dL in the ACE inhibitor group compared with 1.05 ± 0.22 mg/dL in the ARB group, without a statistically significant difference (p=0.086). Mean blood urea nitrogen levels were 19.80 ± 5.30 mg/dL and 18.20 ± 4.90 mg/dL (p=0.113), while mean serum urea levels were 42.40 ± 11.30 mg/dL and 39.00 ± 10.50 mg/dL (p=0.115), respectively. The mean eGFR was comparatively higher among ARB users (81.80 ± 17.40 mL/min/1.73 m²) than ACE inhibitor users (76.50 ± 18.60 mL/min/1.73 m²), although the difference was not statistically significant (p=0.137). An eGFR ≥90 mL/min/1.73 m² was observed in 28.85% of ACE inhibitor users and 38.46% of ARB users, whereas an eGFR of 30–59 mL/min/1.73 m² was observed in 19.23% and 11.54%, respectively (overall p=0.420). Reduced kidney function (eGFR <60 mL/min/1.73 m²) was present in 19.23% of ACE inhibitor users compared with 11.54% of ARB users (p=0.416). Albuminuria was identified in 30.77% and 23.08% of patients, respectively (p=0.508), indicating that the observed differences

in renal function parameters between the two treatment groups were statistically insignificant.

Table 4: Comparison of Serum Electrolyte Levels and Electrolyte Abnormalities Between ACE Inhibitor and ARB Groups (N=104)

Table 4 presents the distribution of serum electrolyte levels and associated electrolyte abnormalities among patients receiving ACE inhibitors and ARBs. The mean serum sodium concentration was 137.60 ± 3.40 mmol/L in the ACE inhibitor group compared with 138.30 ± 3.10 mmol/L in the ARB group, without a statistically significant difference (p=0.275). Mean serum potassium levels were significantly higher among ACE inhibitor users (4.62 ± 0.48 mmol/L) compared with ARB users (4.42 ± 0.44 mmol/L), with a p-value of 0.029. The mean serum chloride concentrations were 102.80 ± 3.80 mmol/L and 103.10 ± 3.50 mmol/L (p=0.676), while bicarbonate levels were 24.10 ± 2.60 mmol/L and 24.50 ± 2.50 mmol/L (p=0.426), respectively. Hyperkalaemia was observed in 17.31% of ACE inhibitor users compared with 5.77% of ARB users, although the difference was statistically insignificant (p=0.122). Hypokalaemia was reported in 1.92% of patients in each group, whereas hyponatraemia occurred in 11.54% and 5.77% of patients, respectively (p=0.488). Hypernatraemia was absent in the ACE inhibitor group but observed in 1.92% of ARB users, indicating that serum potassium was the only assessed electrolyte parameter showing a statistically significant between-group difference.

Table 5: Comparison of Adverse Drug Effects Between ACE Inhibitor and ARB Groups (N=104)

Table 5 summarizes the frequency and distribution of adverse drug effects among patients receiving ACE inhibitors and ARBs for essential hypertension. Dry cough was significantly more common among ACE inhibitor users, affecting 23.08% of patients compared with only 3.85% of ARB users, with a statistically significant difference (p=0.008). Dizziness was reported in 13.46% of patients receiving ACE inhibitors and 9.62% receiving ARBs, without a significant difference (p=0.760). Symptomatic hypotension was observed in 7.69% of ACE inhibitor users compared with 9.62% of ARB users (p=1.000). Similarly, fatigue was reported in 9.62% and 7.69% of patients, respectively, with no statistically significant difference (p=1.000). At least one documented adverse effect was observed in 36.54% of ACE inhibitor users compared with 21.15% of ARB users (p=0.129). Overall, 63.46% of patients receiving ACE inhibitors and 78.85% receiving ARBs experienced no documented adverse effects, suggesting better observed tolerability in the ARB group, although the difference in overall adverse-effect frequency was statistically insignificant.

Table 1: Comparison of Demographic and Baseline Clinical Characteristics Between ACE Inhibitor and ARB Groups (N=104)

Parameters	ACE Inhibitors (n=52)	ARBs (n=52)	p-value
Mean age (years)	53.80 ± 10.70	54.40 ± 11.20	0.781
Male	30 (57.69%)	29 (55.77%)	1.000
Female	22 (42.31%)	23 (44.23%)	—
Rural residence	31 (59.62%)	33 (63.46%)	0.840
Urban residence	21 (40.38%)	19 (36.54%)	—
Duration of hypertension (years)	6.80 ± 3.90	7.00 ± 4.10	0.799
BMI (kg/m²)	27.60 ± 3.70	27.80 ± 3.50	0.778
Diabetes mellitus	18 (34.62%)	20 (38.46%)	0.839
Dyslipidaemia	25 (48.08%)	27 (51.92%)	0.845
Smoking history	12 (23.08%)	11 (21.15%)	1.000

Table 2: Comparison of Blood Pressure Parameters and Blood Pressure Control Between ACE Inhibitor and ARB Groups (N=104)

Parameters	ACE Inhibitors (n=52)	ARBs (n=52)	p-value
Mean systolic BP (mmHg)	137.80 ± 12.90	132.10 ± 12.10	0.022
Mean diastolic BP (mmHg)	86.40 ± 8.80	82.80 ± 8.20	0.033
Mean arterial pressure (mmHg)	103.50 ± 9.50	99.20 ± 9.00	0.020
Pulse pressure (mmHg)	51.40 ± 9.20	49.30 ± 8.70	0.235
Controlled BP (SBP<140 and DBP<90 mmHg)	29 (55.77%)	40 (76.92%)	0.037
Uncontrolled BP	23 (44.23%)	12 (23.08%)	—

Table 3: Comparison of Renal Function Parameters Between ACE Inhibitor and ARB Groups (N=104)

Parameters	ACE Inhibitors (n=52)	ARBs (n=52)	p-value
Serum creatinine (mg/dL)	1.13 ± 0.25	1.05 ± 0.22	0.086
Blood urea nitrogen (mg/dL)	19.80 ± 5.30	18.20 ± 4.90	0.113
Serum urea (mg/dL)	42.40 ± 11.30	39.00 ± 10.50	0.115
eGFR (mL/min/1.73 m²)	76.50 ± 18.60	81.80 ± 17.40	0.137
eGFR categories			0.420
≥90 mL/min/1.73 m²	15 (28.85%)	20 (38.46%)	—
60–89 mL/min/1.73 m²	27 (51.92%)	26 (50.00%)	—
30–59 mL/min/1.73 m²	10 (19.23%)	6 (11.54%)	—
Reduced kidney function (eGFR <60)	10 (19.23%)	6 (11.54%)	0.416
Albuminuria (UACR ≥30 mg/g)	16 (30.77%)	12 (23.08%)	0.508

For illustration, UACR was assumed to be available for all 104 patients. In the actual analysis, the denominator must reflect the number tested.

Table 4: Comparison of Serum Electrolyte Levels and Electrolyte Abnormalities Between ACE Inhibitor and ARB Groups (N=104)

Parameters	ACE Inhibitors (n=52)	ARBs (n=52)	p-value
Serum sodium (mmol/L)	137.60 ± 3.40	138.30 ± 3.10	0.275
Serum potassium (mmol/L)	4.62 ± 0.48	4.42 ± 0.44	0.029
Serum chloride (mmol/L)	102.80 ± 3.80	103.10 ± 3.50	0.676
Serum bicarbonate (mmol/L)	24.10 ± 2.60	24.50 ± 2.50	0.426
Hyperkalaemia (K^+ >5.0 mmol/L)	9 (17.31%)	3 (5.77%)	0.122
Hypokalaemia (K^+ <3.5 mmol/L)	1 (1.92%)	1 (1.92%)	1.000
Hyponatraemia (Na^+ <135 mmol/L)	6 (11.54%)	3 (5.77%)	0.488
Hypernatraemia (Na^+ >145 mmol/L)	0 (0.00%)	1 (1.92%)	1.000

Table 5: Comparison of Adverse Drug Effects Between ACE Inhibitor and ARB Groups (N=104)

Adverse drug effects	ACE Inhibitors (n=52)	ARBs (n=52)	p-value
Dry cough	12 (23.08%)	2 (3.85%)	0.008
Dizziness	7 (13.46%)	5 (9.62%)	0.760
Symptomatic hypotension	4 (7.69%)	5 (9.62%)	1.000
Fatigue	5 (9.62%)	4 (7.69%)	1.000
Any documented adverse effect	19 (36.54%)	11 (21.15%)	0.129
No documented adverse effect	33 (63.46%)	41 (78.85%)	—

DISCUSSION

The present comparative assessment included 104 patients with essential hypertension, equally distributed between the ACE inhibitor and ARB groups. The mean age was 53.80 ± 10.70 years in the ACE inhibitor group and 54.40 ± 11.20 years in the ARB group (p=0.781). Male patients constituted 57.69% and 55.77% of the respective groups, while diabetes mellitus was present in 34.62% and 38.46%. The mean duration of hypertension was 6.80 ± 3.90 years and 7.00 ± 4.10 years, respectively. These findings were comparable with those reported by Rajadhyaksha et al. (2023), who conducted the Indian RECORD registry involving 2,000 hypertensive patients across five centres. They reported a mean age of 54.45 years, with 55.70% male patients and 31.60% having diabetes mellitus. The average duration of pre-existing hypertension was 68.72 months, while 47.85% of patients were newly diagnosed. The similarity in age distribution, male predominance, and prevalence of diabetes indicated that the illustrative study population broadly resembled the clinical characteristics reported in the Indian hypertensive population, although the treatment-group composition differed between the studies.[8]

Blood pressure control represented an important outcome in the present comparison, with significantly lower mean systolic and diastolic blood pressure among patients receiving ARBs. The mean systolic blood pressure was 132.10 ± 12.10 mmHg in the ARB group compared with 137.80 ± 12.90 mmHg in the ACE inhibitor group (p=0.022). Similarly, mean diastolic blood pressure was 82.80 ± 8.20 mmHg and 86.40 ± 8.80 mmHg, respectively (p=0.033). These findings were consistent with Williams et al. (2006), who conducted the PRISMA I randomized study involving 801 patients with mild-to-moderate hypertension and compared telmisartan 80 mg with ramipril 5–10 mg. Telmisartan produced significantly greater reductions in ambulatory systolic and diastolic blood pressure during the final six hours of the dosing interval compared with both ramipril doses (p<0.0001). Furthermore, ambulatory blood pressure response rates were significantly greater with telmisartan (p<0.01). The findings supported the possibility of more sustained blood pressure reduction with certain ARBs, although the present observational comparison could not establish the superiority of the entire ARB class.[9]

The proportion of patients achieving adequate blood pressure control was significantly higher in the ARB group (76.92%) compared with the ACE inhibitor group (55.77%), with a p-value of 0.037. Conversely, uncontrolled hypertension was recorded in 23.08% of ARB users and 44.23% of ACE inhibitor users. These findings were supported by Malacco et al. (2010), who conducted the ESPORT study involving 1,102 elderly patients with essential hypertension, of whom 1,081 were included in the intention-to-treat analysis. After treatment, the mean systolic blood pressure reduction was 17.80 mmHg with olmesartan compared with 15.70 mmHg with ramipril, while the corresponding diastolic reductions were 9.20 and 7.70 mmHg (p<0.01). Blood pressure normalization was achieved in 52.60% of patients receiving olmesartan compared with 46.00% receiving ramipril (p<0.05). Although the normalization rates were lower than those in the present illustrative comparison, both studies demonstrated a higher proportion of controlled patients in the ARB group. Differences in patient age, blood pressure targets, medication doses, and study design could account for the variation in control rates.[10]

Renal function assessment demonstrated comparatively lower serum creatinine and higher eGFR among patients receiving ARBs, although these differences were statistically insignificant. The mean serum creatinine was 1.13 ± 0.25 mg/dL in the ACE inhibitor group compared with 1.05 ± 0.22 mg/dL in the ARB group (p=0.086), while mean eGFR was 76.50 ± 18.60 and 81.80 ± 17.40 mL/min/1.73 m², respectively (p=0.137). Reduced kidney function was recorded in 19.23% of ACE inhibitor users and 11.54% of ARB users (p=0.416). These findings were compared with Barnett et al. (2004), who conducted the DETAIL randomized trial involving 250 patients with type 2 diabetes and early nephropathy, comparing telmisartan with enalapril. After five years, the corrected mean decline in GFR was 17.50 mL/min/1.73 m² with telmisartan compared with 15.00 mL/min/1.73 m² with enalapril, with a treatment difference of −2.60 mL/min/1.73 m² (95% CI: −7.10 to 2.00). Telmisartan was found to be noninferior to enalapril in renal protection. Both studies therefore indicated no statistically established renal superiority of either treatment, although the present comparison evaluated renal function at one assessment rather than longitudinal deterioration.[11]

The distribution of renal impairment and albuminuria provided additional information regarding renal involvement among hypertensive patients receiving renin–angiotensin system inhibitors. In the present illustrative dataset, eGFR ≥90 mL/min/1.73 m² was observed in 28.85% of ACE inhibitor users and 38.46% of ARB users, whereas eGFR between 30 and 59 mL/min/1.73 m² was present in 19.23% and 11.54%, respectively. Albuminuria was recorded in 30.77% of ACE inhibitor users compared with 23.08% receiving ARBs (p=0.508). These findings were compared with Mann et al. (2008), who evaluated renal outcomes in the ONTARGET randomized trial involving 25,620 patients at high vascular risk. The primary composite renal outcome occurred in 13.40% of telmisartan-treated patients and 13.50% of ramipril-treated patients (HR=1.00; 95% CI: 0.92–1.09). However, the decline in eGFR was smaller with ramipril than with telmisartan (−2.82 versus −4.12 mL/min/1.73 m²; p<0.0001), while the increase in urinary albumin excretion was significantly smaller with telmisartan (p=0.004). These findings highlighted the comparable effects of both drugs on major renal outcomes, with differences in individual renal parameters.[12]

Electrolyte assessment demonstrated a statistically significant difference in mean serum potassium levels between the treatment groups. Mean serum potassium was 4.62 ± 0.48 mmol/L among ACE inhibitor users compared with 4.42 ± 0.44 mmol/L among ARB users (p=0.029). Hyperkalaemia was observed in 17.31% and 5.77% of patients, respectively, although this difference was not statistically significant (p=0.122). Other serum electrolyte parameters, including sodium, chloride, and bicarbonate, showed no significant differences. These findings were compared with Salik et al. (2022), who conducted a comparative observational study involving 5,923 patients, including 3,914 ACE inhibitor users and 2,009 ARB users. Hyperkalaemia occurred in 4.20% of patients receiving ACE inhibitors and 4.00% receiving ARBs in unadjusted analysis (OR=1.03; 95% CI: 0.79–1.36). However, after adjustment for clinical characteristics, ACE inhibitor use was associated with greater odds of hyperkalaemia (OR=1.84; 95% CI: 1.28–2.63; p<0.001). The increase from baseline to peak potassium was also greater with ACE inhibitors (0.20 versus 0.10 mmol/L), supporting the importance of potassium monitoring during both treatments.[13]

The assessment of adverse drug effects demonstrated a higher overall frequency of adverse events among ACE inhibitor users (36.54%) compared with ARB users (21.15%), although the difference was statistically insignificant (p=0.129). Dry cough was the most prominent adverse effect, reported in 23.08% of ACE inhibitor users compared with 3.85% of ARB users (p=0.008). Dizziness was recorded in 13.46% and 9.62% of patients, while symptomatic hypotension occurred in 7.69% and 9.62%, respectively. These findings were comparable with Yusuf et al. (2008), who reported the results of the ONTARGET randomized trial comparing ramipril, telmisartan, and their combination in patients at high vascular risk. Cough was reported in 4.20% of patients receiving ramipril compared with 1.10% receiving telmisartan (p<0.001), while angioedema occurred in 0.30% and 0.10%, respectively (p=0.01). Conversely, hypotensive symptoms were more frequent with telmisartan than ramipril (2.60% versus 1.70%; p<0.001). The findings were consistent with the higher frequency of cough among ACE inhibitor users in the present comparison and suggested a more favourable cough-related tolerability profile for ARBs, without demonstrating significant differences in every adverse effect.[14]

CONCLUSION

The present comparative assessment suggested that angiotensin receptor blockers (ARBs) were associated with better blood pressure control and a more favourable tolerability profile than angiotensin-converting enzyme (ACE) inhibitors among patients with essential hypertension. Renal function parameters showed no statistically significant differences between the two groups, although comparatively higher eGFR and lower serum creatinine levels were observed among ARB users. ACE inhibitor users exhibited significantly higher serum potassium levels and a greater incidence of dry cough. These findings highlight the importance of individualized antihypertensive therapy, regular monitoring of renal function and

electrolytes, and careful assessment of adverse drug effects to optimize treatment outcomes.

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