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# Comparative Evaluation of Therapeutic Efficacy between Ramipril and Losartan in Hypertensive Patients with Heart Failure

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**ABSTRACT**
***Background:*** Hypertension with coexisting heart failure (HF) necessitates optimal therapeutic management. Ramipril (an ACE inhibitor) and losartan (an ARB) are commonly used, but their comparative efficacy remains debated in certain populations. This study evaluated the therapeutic outcomes of ramipril versus losartan in hypertensive HF patients. ***Methods:*** A hospital-based comparative study was conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from January 2021 to December 2021. 120 hypertensive HF patients were enrolled via purposive sampling and randomly allocated equally (n=60 each) to ramipril or losartan groups. Baseline demographics, blood pressure (BP), ejection fraction (EF), and NYHA functional class were recorded. Post-treatment changes in BP, EF, and symptom improvement were assessed after 12 weeks. Data were analyzed using SPSS 23.0, with $p<0.05$ considered significant. ***Results:*** Ramipril showed superior systolic BP reduction (- 28.4±6.2 vs -24.1±5.8 mmHg, p=0.013), while losartan demonstrated greater EF improvement (+6.5±1.8% vs +4.9±1.5%, p=0.008). NYHA class improvement was comparable (68.3% vs 71.7%). Cough incidence was higher with ramipril (18.3% vs 3.3%, p=0.003). Both therapies effectively managed hypertension with heart failure, demonstrating distinct therapeutic profiles. ***Conclusion:*** Both ramipril and losartan effectively manage hypertensive heart failure with distinct profiles: ramipril excels in blood pressure control while losartan shows better cardiac improvement. Treatment choice should consider individual patient needs, prioritizing either BP reduction or EF enhancement based on clinical presentation and tolerability.

**Keywords:** ACE inhibitor, ARB. Bangladesh, Heart failure, Hypertension, Ramipril, Losartan.

## INTRODUCTION

Hypertension remains one of the most significant global health challenges, affecting approximately 1.3 billion adults worldwide and contributing substantially to cardiovascular morbidity and mortality [1]. When hypertension coexists with heart failure, the clinical complexity increases dramatically as elevated blood pressure accelerates ventricular remodeling and worsens cardiac function [2,3]. This dual pathology requires careful pharmacological management to control blood pressure while simultaneously improving cardiac outcomes, presenting a therapeutic challenge for clinicians [4]. The renin-angiotensin-aldosterone system plays a central role in the pathophysiology of both conditions, making its modulation through pharmacological intervention a cornerstone of treatment [5]. Among available therapies, angiotensin-converting enzyme inhibitors like ramipril have demonstrated significant benefits in reducing mortality and hospitalization rates in heart failure patients through their effects on afterload reduction and ventricular remodeling [6,7]. In contrast, angiotensin receptor blockers such as losartan offer comparable hemodynamic benefits while potentially avoiding certain class-specific adverse effects associated with ACE inhibitors, particularly dry cough and angioedema [8,9]. Both drug classes are recommended in current guidelines for hypertensive patients with heart failure, yet direct comparisons of their therapeutic efficacy continue to show conflicting results [10]. Some clinical studies suggest superior outcomes with ACE inhibitors regarding mortality reduction, while others report better tolerability and similar efficacy with ARBs [11,12]. These discrepancies may be particularly relevant in South Asian populations, where genetic polymorphisms in drug metabolism and differing patterns of comorbidities could significantly influence treatment responses [13,14]. In Bangladesh, where hypertension prevalence exceeds 20% and heart failure represents a growing public health concern, there remains a critical lack of local data comparing these therapeutic approaches [15]. Most clinical decisions are currently based on international guidelines that may not fully account for regional variations in drug response patterns and patient characteristics [16]. The current study was conducted at Joy Hospital in Dhaka to address these knowledge gaps through a systematic comparison of ramipril and losartan in hypertensive patients with heart failure. Our research focused on evaluating several clinically relevant parameters including comparative efficacy in blood pressure control, differential effects on cardiac function as measured by ejection fraction, improvements in symptoms and functional capacity according to NYHA classification, and comprehensive assessment of safety and tolerability profiles. By providing locally relevant evidence from a real-world clinical setting, this study aims to inform treatment decisions and potentially optimize management strategies for this high-risk patient population in Bangladesh and similar healthcare contexts where resources may be limited but the burden of cardiovascular disease continues to rise.

## METHODOLOGY

This hospital-based, prospective, comparative study was conducted at Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, from January 2021 to December 2021. A total of 120 hypertensive patients with coexisting heart failure (NYHA class II-III) were enrolled through purposive sampling and randomly allocated into two equal groups (n=60 each) receiving either ramipril (5-10 mg/day) or losartan (50-100 mg/day). Baseline assessments included detailed medical history, physical examination, blood pressure measurement, echocardiographic evaluation of ejection fraction (EF), and NYHA functional class classification [17]. Patients were followed up for 12 weeks with monthly clinical assessment to monitor treatment responses. Primary outcomes included changes in systolic and diastolic blood pressure from baseline. Secondary outcomes comprised improvements in EF, NYHA functional class, and incidence of adverse drug reactions. Blood pressure was measured using standardized mercury sphygmomanometers, while EF was assessed via echocardiography by blinded cardiologists. Data were analyzed using SPSS version 23.0, employing paired t-tests for within-group comparisons and independent t-tests for between-group analyses. Categorical variables were compared using chi-square tests, with $p<0.05$ considered statistically significant. The institutional ethics committee approved the study protocol, and written informed consent was obtained from all participants.

## RESULT

The study compared the therapeutic efficacy of ramipril and losartan in 120 hypertensive patients with heart failure over 12 weeks. Baseline characteristics showed comparable demographics between groups, with mean age 58.3±8.7 years in the ramipril group versus 57.9±9.1 years in the losartan group (p=0.782). Both groups had similar proportions of males (55% vs 53.3%) and comorbidities including diabetes (31.7% vs 35%) and dyslipidemia (43.3% vs 40%). Blood pressure control demonstrated significant reductions in both groups. Ramipril showed superior systolic BP reduction (Δ28.4±6.2 mmHg vs Δ24.1±5.8 mmHg, p=0.013), while diastolic BP reductions were comparable (Δ14.2±3.1 mmHg vs Δ13.8±3.4 mmHg, p=0.421). Cardiac function improved in both groups, with losartan showing greater EF improvement (Δ6.5±1.8% vs Δ4.9±1.5%, p=0.008). NYHA class improvement was similar between groups (p=0.342), with 68.3% of ramipril and 71.7% of losartan patients improving by ≥1 class. Safety profiles differed significantly. Ramipril had higher cough incidence (18.3% vs 3.3%, p=0.003), while losartan showed more dizziness (10% vs 3.3%, p=0.042). Other adverse events

including hyperkalemia (5% vs 6.7%) and renal dysfunction (3.3% vs 5%) were comparable. Laboratory parameters, including serum creatinine, potassium, and lipid profiles, remained stable in both groups.

**Table 1: Baseline demographic and clinical characteristics**

| Characteristic | Ramipril (n=60) | Losartan (n=60) | p-value |
|---|---|---|---|
| **Age (years)** | 58.3 ± 8.7 | 57.9 ± 9.1 | 0.782 |
| **Male sex, n (%)** | 33 (55) | 32 (53.3) | 0.854 |
| **BMI (kg/m²)** | 26.4 ± 3.2 | 25.9 ± 3.5 | 0.421 |
| **Diabetes, n (%)** | 19 (31.7) | 21 (35) | 0.704 |
| **Baseline SBP (mmHg)** | 158.2 ± 12.3 | 156.7 ± 11.8 | 0.512 |
| **Baseline EF (%)** | 38.7 ± 5.2 | 39.2 ± 5.6 | 0.612 |

**Analysis:** Continuous variables compared using an independent Student's t-test; categorical variables using $\chi^2$ test.

**Table 2: Blood pressure changes from baseline**

| Parameter | Ramipril (Δ) | Losartan (Δ) | p-value |
|---|---|---|---|
| **SBP (mmHg)** | -28.4 ± 6.2 | -24.1 ± 5.8 | 0.013 |
| **DBP (mmHg)** | -14.2 ± 3.1 | -13.8 ± 3.4 | 0.421 |
| **MAP (mmHg)** | -19.1 ± 4.3 | -17.2 ± 4.1 | 0.035 |

**Analysis:** Paired t-test for within-group changes; independent t-test for between-group comparisons.

**Table 3: Cardiac function parameters**

| Parameter | Ramipril (Δ) | Losartan (Δ) | p-value |
|---|---|---|---|
| **EF (%)** | +4.9 ± 1.5 | +6.5 ± 1.8 | 0.008 |
| **LVEDD (mm)** | -3.2 ± 1.1 | -3.8 ± 1.3 | 0.042 |
| **LVESV (mL)** | -12.7 ± 4.2 | -15.3 ± 4.8 | 0.021 |

**Analysis:** Linear mixed models adjusted for baseline values.

**Table 4: NYHA functional class improvement**

| Category | Ramipril | Losartan | p-value |
|---|---|---|---|
| **Improved** | 41 (68.3%) | 43 (71.7%) | 0.689 |
| **Stable** | 16 (26.7%) | 14 (23.3%) | |
| **Worsened** | 3 (5.0%) | 3 (5.0%) | |

**Analysis:** Ordinal logistic regression.

**Table 5: Adverse event incidence**

| Event | Ramipril | Losartan | RR (95% CI) | p-value |
|---|---|---|---|---|
| **Cough** | 11 (18.3%) | 2 (3.3%) | 5.50 (1.25-24.2) | 0.003 |
| **Dizziness** | 2 (3.3%) | 6 (10.0%) | 0.33 (0.07-1.59) | 0.042 |

**Analysis:** Fisher's exact test with relative risk calculation.

**Table 6: Laboratory parameter changes**

| Parameter | Ramipril (Δ) | Losartan (Δ) | p-value |
|---|---|---|---|
| **eGFR (mL/min)** | -2.1 ± 3.8 | -1.8 ± 3.5 | 0.672 |
| **Potassium (mmol/L)** | +0.3 ± 0.2 | +0.4 ± 0.2 | 0.087 |
| **NT-proBNP (pg/mL)** | -425 ± 187 | -387 ± 165 | 0.214 |

**Analysis:** ANCOVA with baseline adjustment.

## DISCUSSION

The present study provides valuable comparative data on the efficacy and safety of ramipril versus losartan in hypertensive patients with coexisting heart failure, demonstrating distinct therapeutic profiles for these two RAAS-modulating agents. Our findings align with previous reports showing superior blood pressure control with ACE inhibitors compared to ARBs [18], while also revealing important differences in cardiac functional improvement and adverse effect profiles that merit careful consideration in clinical practice. The significantly greater reduction in systolic blood pressure with ramipril (Δ28.4 vs. Δ24.1 mmHg, p=0.013) reinforces existing evidence supporting the potent antihypertensive effects of ACE inhibitors [19]. This finding is particularly relevant for the study population, as systolic hypertension represents a major modifiable risk factor for heart failure progression in South Asian populations [20]. The mechanism may relate to ramipril's dual action on both angiotensin II formation and bradykinin potentiation, which enhances vasodilation beyond ARB-mediated receptor blockade alone [21]. Contrasting with blood pressure outcomes, losartan demonstrated superior improvement in ejection fraction (Δ6.5% vs. Δ4.9%, p=0.008), supporting emerging evidence that ARBs may offer particular benefits in ventricular remodeling [22]. This finding echo results from the ELITE II trial, which suggested more robust reverse remodeling with ARBs in certain heart failure phenotypes [23]. The differential effects on cardiac function versus blood pressure control highlight the complexity of therapeutic decision-making in this comorbid population, where both parameters critically influence outcomes [24]. The safety profiles observed in our study corroborate well-established patterns of adverse effects associated with each drug class. The significantly higher incidence of cough with ramipril (18.3% vs. 3.3%, p=0.003) mirrors previous reports of ACE inhibitor-induced cough in up to 20% of Asian populations [25], likely related to genetic polymorphisms in bradykinin metabolism [26]. Conversely, the trend toward more dizziness with losartan (10% vs. 3.3%, p=0.042) may reflect its more specific angiotensin receptor blockade without compensatory bradykinin-mediated vasodilation [27]. Several findings from our study carry particular significance for clinical practice in Bangladesh and similar resource-limited settings. First, the comparable rates of NYHA class improvement (68.3% vs. 71.7%, p=0.342) suggest that functional status benefits may be achieved with either agent when titrated appropriately. Second, the absence of significant renal function deterioration with either drug supports their safety in this population, addressing a common concern among practitioners [28]. Third, the differential cost and availability of these medications in low-resource settings may influence prescribing decisions despite comparable efficacy [29]. Our results should be interpreted considering certain limitations. The relatively short 12-week follow-up period precludes assessment of long-term outcomes like mortality or hospitalization rates. The single-center design may limit generalizability, though the study population reflects typical patients in urban Bangladeshi hospitals. The fixed-dose regimen, while simplifying comparison, doesn't account for potential benefits of individualized dose titration.

### Limitations:

This study has several limitations, including its single-center design, relatively small sample size, and short 12-week follow-up period, which may limit the generalizability of findings. Additionally, the fixed-dose regimen did not account for the potential benefits of individualized dose titration in clinical practice.

## CONCLUSION

This study demonstrates that while ramipril provides superior blood pressure control, losartan offers better cardiac function improvement in hypertensive heart failure patients. The differential safety profiles (cough with ramipril vs. dizziness with losartan) suggest that treatment should be individualized. Both drugs effectively improved functional status, supporting their use in Bangladesh's resource-limited settings where the heart failure burden is rising.

### Recommendation:

For optimal management of hypertensive heart failure patients, clinicians should consider ramipril for superior blood pressure control and losartan for better cardiac remodeling. Individualized therapy based on patient tolerance and predominant clinical needs (BP control vs. EF improvement) is advised. Further large-scale studies with longer follow-up are warranted to validate these findings.

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