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Original Article

EVALUATING THE COST-EFFECTIVENESS OF AMLODIPINE WITH ATENOLOL VERSUS AMLODIPINE WITH TELMISARTAN IN A RURAL COMMUNITY HEALTH CENTER, ANDHRAPRADESH

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ABSTRACT

Objective: The objective of this study was to compare the cost-effectiveness of two antihypertensive combinations, Amlodipine with Atenolol and Amlodipine with Telmisartan, among hypertensive patients attending a rural community health centre in Andhra Pradesh. The study aimed to evaluate the economic efficiency of these regimens in relation to their clinical outcomes. Specific objectives included assessing the clinical effectiveness of both combinations in controlling systolic and diastolic blood pressure and determining their respective cost-effectiveness ratios for the target population. The findings were intended to identify a clinically effective and economically sustainable antihypertensive therapy suitable for resource-limited rural healthcare settings.

Methods: A prospective observational study was conducted over two months among 106 hypertensive patients, divided equally into two treatment groups (n1 = 53; n2 = 53). Blood pressure measurements were recorded at baseline and during two follow-up visits at one-month intervals. Drug costs were obtained from the hospital pharmacy index. Clinical effectiveness was assessed through reductions in systolic and diastolic blood pressure, and pharmacoeconomic evaluation was performed using cost-effectiveness ratios and incremental cost-effectiveness ratio (ICER).

Results: Both combinations produced significant reductions in systolic blood pressure readings ($p<0.05$) mean diastolic blood pressure reduction was almost similar in both groups, while mean systolicblood pressure reduction was significant. Pricing analysis showed substantially lower costs for the Amlodipine+Atenolol regimen. Cost-effectiveness analysis revealed more favourable outcomes for Amlodipine+Atenolol (C/E = 1.24) compared with Amlodipine+Telmisartan (C/E = 1.86). The ICER value (8.26) indicated that the Telmisartan combination provided minimal additional benefit at a significantly higher cost.

Conclusion: Although both regimens effectively lowered blood pressure, Amlodipine+Atenolol demonstrated markedly superior cost-effectiveness. This combination represents a more affordable and sustainable option for hypertension management in rural primary care settings, supporting its preferential use in resource-limited populations.

Keywords: Cost effectiveness, Amlodipine, Atenolol, Telmisartan, Hypertension, ICER

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INTRODUCTION

Hypertension is a major global public health concern and a leading modifiable risk factor for cardiovascular morbidity and mortality. Its burden is particularly pronounced in rural regions, where access to healthcare services is limited and healthcare infrastructure remains inadequate. In India, the prevalence of hypertension is steadily increasing, significantly contributing to cardiovascular diseases, stroke, and chronic kidney disease. Rural communities, especially in states such as Andhra Pradesh, face unique challenges in hypertension management due to financial constraints, low health awareness, poor accessibility to medical facilities, and limited availability of essential medicines [1, 6-8].

Despite the availability of effective antihypertensive therapies, blood pressure control rates remain suboptimal in rural India. Several factors contribute to poor control, including polypharmacy, adverse drug reactions, poor follow-up, inconsistent drug supply, and suboptimal treatment adherence [8, 9]. Fixed-dose combination (FDC) therapies have emerged as a practical strategy to overcome these barriers by simplifying treatment regimens, improving adherence, and enhancing blood pressure control [10-12]. However, the widespread use of FDCs in rural healthcare systems raises concerns regarding their affordability and long-term economic sustainability, particularly in publicly funded settings.

The choice of antihypertensive medication is therefore a critical determinant of effective blood pressure control, especially in resource-constrained environments [2]. While multiple drug combinations demonstrate comparable clinical efficacy, their economic impact varies substantially. Cost-effectiveness analysis (CEA) is an essential pharmacoeconomic tool that compares the costs and health outcomes of different therapeutic options, enabling clinicians and policymakers to identify treatments that provide maximum health benefit at minimal cost [3, 4]. Such analyses are particularly valuable in rural health centres, where limited budgets necessitate rational drug selection to optimize outcomes while minimizing healthcare expenditure.

Beta-blocker–based combinations, such as amlodipine with atenolol, have traditionally been widely prescribed in India due to their low cost and widespread availability [13]. In contrast, angiotensin receptor blocker (ARB)–based combinations, including amlodipine with telmisartan, are increasingly preferred because of superior metabolic profiles, improved tolerability, and favourable cardiovascular outcomes [2, 9]. However, ARB-based regimens are generally associated with higher acquisition costs, raising concerns regarding their economic justification in low-resource rural settings. Comparative pharmacoeconomic evaluations of these commonly used combinations are therefore essential to guide rational prescribing practices at the primary care level.

Evidence from international and Indian studies highlights the importance of integrating cost-effectiveness data into hypertension treatment guidelines, particularly in low-and middle-income countries with constrained healthcare budgets [4, 5, 14]. Such evaluations support equitable access to essential antihypertensive therapies while promoting efficient resource utilization. However, there remains a paucity of real-world cost-effectiveness data from rural Indian

healthcare settings, underscoring the need for context-specific analyses.

In this context, the present study aims to evaluate the cost-effectiveness of amlodipine with atenolol versus amlodipine with telmisartan in a rural community health centre in Andhra Pradesh. By comparing clinical outcomes and economic implications, this study seeks to identify affordable and effective antihypertensive treatment options that can optimize resource allocation and improve hypertension management in rural India [3-5, 15].

MATERIALS AND METHODS

Study design

A prospective observational study.

Duration of the study

A period of 2 mo of duration of the study after the approval of Institutional Scientific Committee and Institutional Ethics Committee.

Place of study

Community Health Centre, Chittoor (dist.), A. P.

Sample size

According to the study done by Pal B, Dutta A, Chaudhary V, Kumari S, Meenakshi S, Murti K, 2024, the prevalence of antihypertensive medication adherence and associated factors in India, the pooled prevalence of antihypertensive medication is 15.8% [16].

The sample size for a single-group study with qualitative outcome at 95% CI is N = 106

They are divided in to two groups with sample size of $n_1 = 53$, $n_2 = 53$.

n_1 is the group taking combination of Amlodipine with Atenolol.

n_2 is the group taking combination of Amlodipine with Telmisartan.

Study population

All hypertensive patients attending the community health centre during the study period.

Inclusion criteria

Patients aged 18 y and above diagnosed with hypertension.

Patients receiving antihypertensive drug therapy at the selected Community Health Centre.

Patient willing to provide written informed consent.

Exclusion criteria

Patients that have changed antihypertensive medication within the last 3 mo.

Study method

The approval from the Institutional Ethics Committee was obtained, and then the study was initiated. Informed and written consent was obtained from the patients enrolled in the study. At the Community Health Centre, prescriptions of hypertensive patients were reviewed and were divided into two groups: patients taking Amlodipine with Atenolol were considered as group n1 (n1 = 53), and patients taking Amlodipine with Telmisartan were considered as group n2 (n2 = 53), making a total sample size of N = 106. Blood pressure readings (systolic and diastolic) were recorded at the first visit as baseline, again at the second visit after one month, and at the third visit after two months. Classes of drugs prescribed from the prescriptions were observed during the study period. The cost of these drugs, obtained from the current index of the hospital pharmacy, was noted.

The original prescriptions were given back to the patients after noting the drugs prescribed to the concerned patient, and the clinical effectiveness (CE) and cost-effectiveness of Amlodipine with Atenolol and Amlodipine with Telmisartan combination pills were analysed using the incremental cost-effectiveness ratio (ICER).

Data analysis

Data entered in microsoft excel sheet and analysed in Epi info software v 7.2.3. All categorical variables are presented in frequencies and percentages and continuous variables are presented in mean and standard deviation, paired and unpaired student t-test was used to analyse the P-value.

Ethical consideration

Before collecting data, all patients are briefed about the purpose of study and written informed consent was obtained.

Confidentiality of patient data is strictly maintained.

Patients have the right to withdraw from study at any stage.

The study does not cause any financial burden to the patient.

RESULTS

A total of 106 patients were enrolled, with 53 in each treatment group. As shown in table 1, both groups were comparable in baseline characteristics. The mean ages were almost similar (56.1±13.3 vs. 58.1±13.1 y), and the sex distribution had shown the difference.

Table 1: Demographic and baseline characteristics data

Characteristics		Amlodipine+Atenolol	Amlodipine+Telmisartan
No. of participants		53	53
Age (Years) (Mean±SD)		56.1±13.3	58.1±13.1
Sex	Male	31	29
	Female	22	24

The pricing analysis (table 2) indicated that the Amlodipine+Atenolol combination was substantially cheaper across minimum, average, and ceiling price categories compared with Amlodipine+Telmisartan, which showed considerably higher cost.

Table 2: Pricing profile of amlodipine+atenolol, amlodipine+telmisartan fixed dose combinations

Drug	Quantity	Dose (mg)	Ceiling price (Rs)	Minimum price (Rs)	Average price (Rs)
Amlodipine+Atenolol	61	Amlodipine (10 mg)+Atenolol (50 mg)	306.83	46.335	143.35
Amlodipine+Telmisartan	61	Amlodipine (10 mg)+Telmisartan (40 mg)	1154.73	76.067	390.4

Both treatment groups demonstrated significant reductions in systolic blood pressure across visits. As shown in table 3, SBP decreased markedly from baseline to the third visit in both groups, with within-group significance ($p<0.001$). A statistically significant difference was observed between groups in mean SBP reduction ($p = 0.0236$).

Table 3: Comparison of systolic blood pressure (SBP), AT 1st, 2nd, 3rd visits

Characteristics		Amlodipine+Atenolol	Amlodipine+Telmisartan	P-Value
SBP	1st Visit	155.6±6.7	158.1±4.8	-
	2st visit	123.2±4.0	122.2±4.5	-
	3rd visit	118.3±3.5	117.2±2.6	-
Mean reduction in SBP from 1st to 3rd visit		37.3±7.5	40.9±5.45	0.0236**
P-Value		<0.001**	<0.001**	

**= P<0.05 – significant, Diastolic blood pressure also decreased significantly in both groups (table 4) mean DBP reduction was comparable between Amlodipine+Atenolol (12.6±2.5 mmHg) and Amlodipine+Telmisartan (13.0±2.7 mmHg), with no significant intergroup difference (p = 0.889).

Table 4: Comparison of diastolic blood pressure (DBP), at 1st, 2nd, 3rd visits

Characteristics		Amlodipine+Atenolol	Amlodipine+Telmisartan	P-Value
DBP	1st Visit	93.0±2.8	92.3±2.5	-
	2st visit	86.0±2.5	83.8±2.7	-
	3rd visit	80.4±2.2	78.8±2.3	-
mean reduction in DBP from 1st to 3rd visit		12.6±2.5	13.0±2.7	0.889
P-Value		<0.001**	<0.001**	

** = P<0.05 – significant, Pharmacoeconomic analysis (table 5) showed that although Telmisartan produced slightly greater clinical effectiveness, the total cost and cost-effectiveness ratio favoured Amlodipine+Atenolol, which demonstrated better economic efficiency (C/E = 1.24 vs. 1.86).

Table 5: Comparison of clinical effectiveness and incremental cost-effectiveness ratio (ICER)

Characteristics	Amlodipine+Atenolol	Amlodipine+Telmisartan
Total cost	2455.76	4031.55
Cost (C)	46.335	76.067
Effectiveness (E)	37.3±7.5 mmHg	40.9±5.45 mmHg
C/E	1.24	1.86
ICER	8.26	

DISCUSSION

The present study evaluated the comparative clinical efficacy and cost-effectiveness of Amlodipine+Atenolol versus Amlodipine+Telmisartan among hypertensive patients attending a rural community health centre in Andhra Pradesh. Both treatment groups demonstrated significant reductions in systolic and diastolic blood pressure across the follow-up period, consistent with the established role of calcium channel blocker–based combination therapy in hypertension management [8, 9]. However, notable differences emerged in terms of economic value, with the Amlodipine–Atenolol combination showing superior cost-effectiveness despite comparable clinical outcomes [10].

The finding that Amlodipine+Telmisartan produced slightly greater systolic BP reduction aligns with previous trials demonstrating the vasodilatory synergy between calcium channel blockers (CCBs) and angiotensin receptor blockers (ARBs). ARBs, particularly telmisartan, have been shown to confer enhanced endothelial effects and improved 24-hour BP control, especially among patients with heightened renin–angiotensin system activation [12]. Nevertheless, the incremental clinical benefit observed in the present study was small and did not translate into meaningful improvement in overall treatment value when cost parameters were introduced [14].

International and Indian cost-effectiveness assessments have consistently emphasized that drug pricing plays a defining role in determining the economic feasibility of antihypertensive regimens. Systematic reviews from other studies have shown that while ARB-based combinations may offer favourable pharmacological profiles, their higher acquisition costs frequently limit their cost-effectiveness, especially in low-resource settings [12, 14]. The current study reinforces this pattern, as reflected by the ICER of 8.26, indicating that the Telmisartan combination requires a disproportionately higher expenditure for minimal incremental clinical benefit.

The results also resonate with national evidence underscoring the importance of affordability in improving adherence among Indian hypertensive patients. Economic barriers remain a major contributor to treatment discontinuation in rural areas, where patients typically rely on government-supplied medicines and have limited financial flexibility. The lower cost and adequate BP-lowering efficacy of Amlodipine+Atenolol therefore position it as a more realistic and sustainable therapeutic option for large segments of the rural population [6, 8].

Taken together, the study findings highlight a clinically relevant but economically significant divergence between the two regimens. While Telmisartan-based combinations maintain a strong clinical profile, the Atenolol-based regimen better reflects the priorities of public health practice in resource-limited environments, where cost-effective management strategies are essential to long-term hypertension control [15].

CONCLUSION

In this prospective evaluation of two commonly used fixed-dose antihypertensive combinations, both Amlodipine+Atenolol and Amlodipine+Telmisartan were effective in reducing systolic and diastolic blood pressure among rural hypertensive patients. Although the Telmisartan combination demonstrated marginally superior systolic BP reduction, this benefit was limited in magnitude and was offset by substantially higher treatment costs. The resulting ICER of 8.26 indicates poor economic efficiency when compared to the Atenolol-based regimen.

Given its strong balance of efficacy, affordability, and accessibility, Amlodipine+Atenolol emerges as the more cost-effective option for hypertension management in rural primary care settings. The findings support the incorporation of economically sustainable combination therapies into public health programmes to improve treatment adherence and long-term cardiovascular outcomes in underserved populations.

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AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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