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Original Research Article

Amlodipine versus Benidipine for Essential Hypertension – A Comparison of Therapeutic Efficacy and Safety

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Conflict of interest: Nil

Abstract:

Introduction: Atherosclerotic disorders are greatly exacerbated by hypertension. When it comes to the management of hypertension, calcium channel blockers (CCBs) are among the most common and effective tools for lowering blood pressure. The most effective class of calcium channel blockers is the dihydropyridine family, which includes amlodipine and the next-generation drug benidipine. Patients with uncomplicated hypertension who visited tertiary care facilities were the subjects of this study, which aimed to compare the efficacy of amlodipine and benidipine.

Material and Methods: One hundred twelve individuals ranging in age from 21 to 65 years old were found to have simple hypertension, defined as blood pressure readings of 140/90 mm Hg or higher. Each participant was assigned to one of two groups and given either amlodipine 2.5 mg or benidipine 4 mg orally once daily in the morning. We documented adverse event details and baseline, 6-week, and 12-week post-treatment serum creatinine and urine albumin levels.

Results: T there was a statistically significant difference ($p<0.05$) in the study groups' mean systolic and diastolic blood pressure readings. symptoms such as swelling in the ankles (28.57%), headache (5.35%), albuminuria in the urine (5.35%), nausea and vomiting (3.58%), giddiness (3.58%), and palpitations (1.78%). In group A, the mean serum creatinine level was 0.90 mg/dl, while in group B, it was 0.88 mg/dl.

Conclusion: The antihypertensive effects of amlodipine and benidipine are comparable when taken alone. Although both groups took systolic blood pressure medication, the Benidipine group showed a considerable improvement in mean difference compared to the Amlodipine group.

Keywords: Uncomplicated hypertension, Amlodipine, Benidipine, Efficacy, Ankle edema.

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Introduction

Hypertension defined as SBP over 140 mmHg and DBP over 90 mmHg and is strongly linked to Cardiovascular illness [1]. The absence of symptoms makes it a silent killer [2]. Hypertension and cardiovascular diseases caused by uncontrolled hypertension are developing rapidly in India [3]. In 2019, a national survey found one in three Indian adults had hypertension [4]. Hypertension is the main cardiovascular disease risk factor in India [5]. However, hypertension awareness and control are low nationwide [6].

In addition, Indians have a large seasonal blood pressure shift and various cardiovascular risk factors that necessitate hypertension control. Management options include lifestyle changes and antihypertensive medications. calcium channel blockers (CCBs) as first-line hypertension treatment, especially for persons over 60 [3]. Common hypertension drugs include calcium channel blockers, which work by blocking the voltage-gated calcium channels of the tunica media of vessels [7]. They were classified into three groups according to the type of calcium channel they obstruct: L type, L/T type, and L/N type [8]. Amlodipine can prevent the action of voltage-dependent L-type calcium channels. Benidipine, a dihydro dihydropyridine calcium channel blocker and a triple L, N, and T-calcium channel blocker, may provide end organ protection [9,10]. Reflex tachycardia and pedal edema are among the minor adverse effects of amlodipine. Therefore, this study set out to evaluate amlodipine and benidipine for

the treatment of cases with uncomplicated hypertension.

Material and Methods

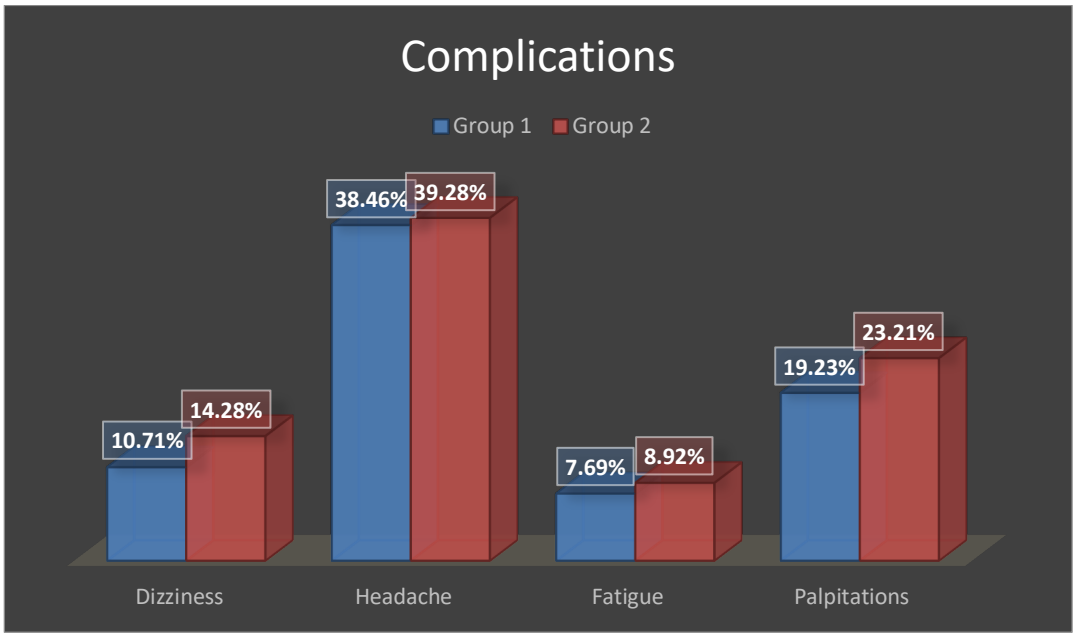
This prospective observation study included 112 participants who were diagnosed with uncomplicated hypertension attending OPD of Department of General Medicine at Maheshwara Medical College and Hospital from April 2023 to February 2024 were recruited. Cases above 21 years of age, with blood pressure ≥140/90 mm Hg and willing participate were included. Cases under antihypertensive drug treatment, without uncomplicated hypertension, cardiovascular complications, pregnancy, lactation, anaemia and not willing to participate were excluded. The written informed consent was obtained from all the participants and study protocol was approved by institutional ethics committee.

Participants in the study were divided into one of two groups at random. Taken first thing in the morning, Group 1 received 2.5 mg of amlodipine daily. Group 2 on the other hand, was given 4 mg of Benidipine daily, likewise administered first thing in the morning. Every patient was thoroughly examined clinically and tested in laboratories. Using a semi-structured proforma created especially for this study, the participants' clinical background and demographic data were obtained. During the course of three months, the physician took the patients' sitting blood pressure in their right arm using the auscultatory technique. After the same doctor took three blood pressure readings spaced ten to fifteen minutes apart, ankle edema was found bilaterally across the medial malleolus. If there is swelling in either leg, ankle edema is regarded to be present. The proforma guided the screening of participants, who were then enrolled in the research should any difficulty surface. Urine albumin and serum creatinine were measured at baseline, six weeks later, and twelve weeks later. The data comparison was conducted using chi-square test. Categorical variables were represented in frequency and percentages and continuous variable were represented in mean and SD. The $p<0.05$ is depicted as statistically significant outcome.

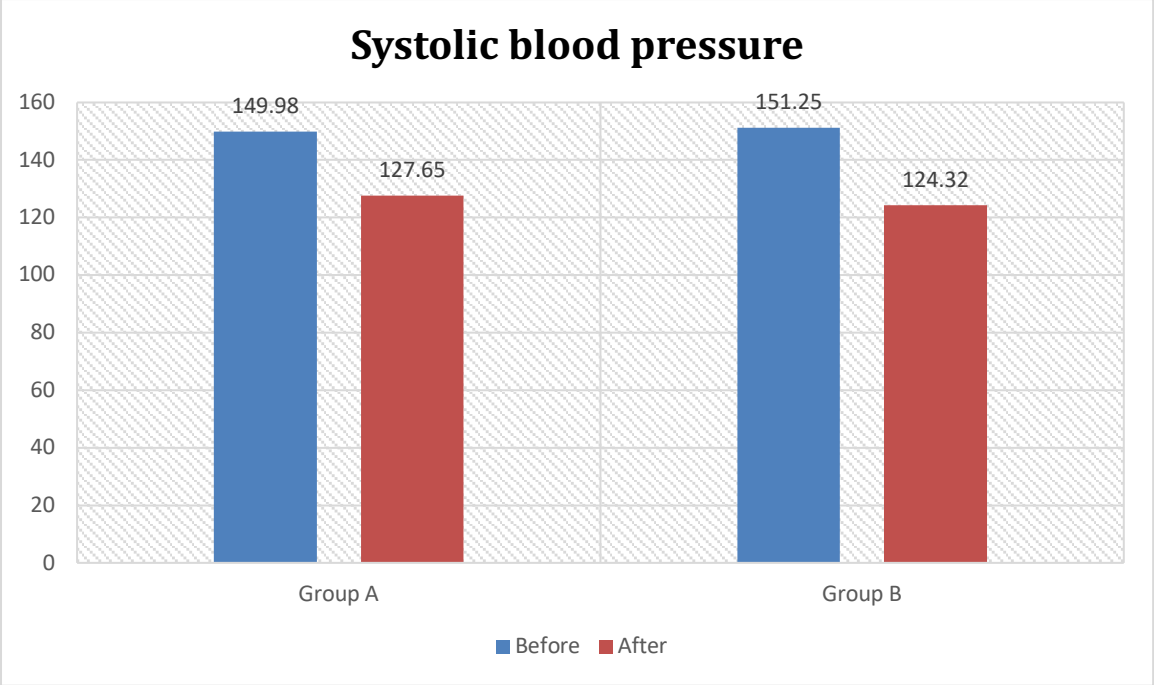
Results

Table 1: Demographic characteristics of the study groups

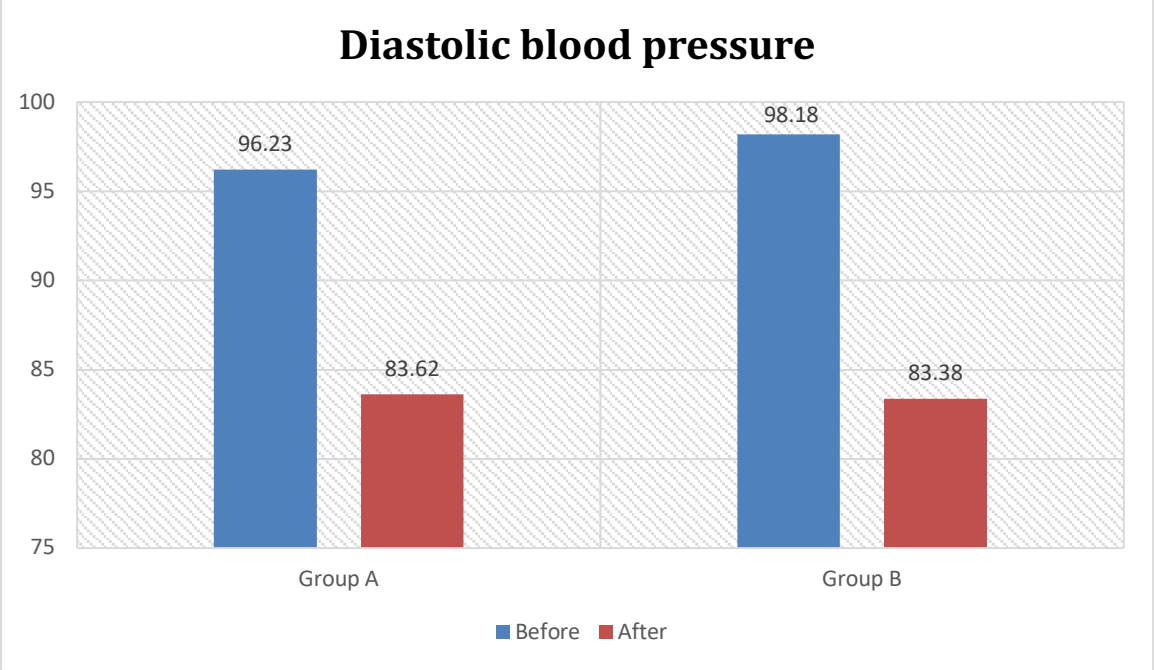
Parameter	Group 1 (n=56)		Group 2 (n=56)		Chi-square value	p-value
	Frequency	Percentage	Frequency	Percentage		
Age (In years)						
21-40	10	17.85%	12	21.42%	0.873	0.285
41-60	32	57.14%	31	55.36%		
>60	14	25%	13	23.31%		
Gender						
Male	35	62.5%	37	66.07%	-	-
Female	21	37.5%	19	33.92%		
BMI (Kg/m^2)	25.48±2.77		26.94±3.56		0.216	0.001



Graph 1: Complications associated among the study participants



Graph 2: Levels of systolic blood pressure before and after treatment



Graph 3: Levels of Diastolic blood pressure before and after treatment

Table 2: Details of laboratory parameter and adverse events among two study groups

Parameters	Group 1	Group 2	p-value
Serum Creatinine (mg/dl)	0.90±0.06	0.88±0.09	0.133
Urine Albumin			
Present	02 (3.57%)	01 (1.78%)	0.001
Absent	54 (96.42%)	55 (98.21%)	
Ankle edema			
Present	15 (26.79%)	09 (14.28%)	0.0216
Absent	41 (73.21%)	47 (83.92%)	
Adverse events			
Headache	03 (5.35%)		-

Nausea/vomiting	02 (3.58%)	
Palpitations	01 (1.78%)	
Ankle edema	16 (28.57%)	
Giddiness	02 (3.58%)	
Urine albuminuria	03 (5.35%)	

Discussion

The majority of participants in both study groups (57.14% in group 1 and 55.36% in group 2) were between the ages of 41 and 60, with the next age groups being above 60 and 21 to 40. In groups 1 and 2, the mean age was 52.40% and 51.55%, respectively. Age differences were significantly significant ($p<0.05$) in mean. There were more male participants in both study groups. Group 1's mean BMI was 25.48 kg/m2, while group 2's mean BMI was 26.94 kg/m2 (Table 1). The most frequently reported problem in both study groups was headache (38.46% vs. 39.28%), which was followed by palpitations (19.23% vs. 23.21%), dizziness (10.71% vs. 14.28%), and fatigue (7.69% vs. 8.92%) (Graph 1). Following therapy, there was a significant reduction in both study groups' mean systolic and diastolic blood pressure values ($p<0.05$) (Graph 2 & 3). The mean difference of systolic blood pressure (SBP) and diastolic blood pressure (DBP) the study groups were statistically significant ($p<0.05$). Serum creatinine levels were 0.90 mg/dl in group 1, while in group 2 were 0.88 mg/dl. In 3.57% of cases in group 1 and 1.78% of cases in group 2, urine albumin was detected. In groups 1 and 2, ankle edema was observed in 26.79% and 14.28% of cases, respectively. Ankle edema, urine albumin, and serum creatinine differences across the research groups were statistically significant ($p<0.05$) (Table 2). The most often reported adverse event was ankle edema (28.57%), which was followed by headache (5.35%), urine albuminuria (5.35%), nausea & vomiting (3.58%), giddiness (3.58%), and palpitations (1.78%) (Table 2).

Sowjanya SL et al. found that among 134 patients with uncomplicated hypertension, 35.82% in Group A and 10.44% in Group B experienced ankle edema. The patients in Group A were given amlodipine 2.5 mg, while those in Group B were randomly assigned to receive benidipine 4 mg. Group A had an average serum creatinine level of 0.92 mg/dl, while Group B had an average level of 0.87 mg/dl. After pharmacological therapy, the mean systolic blood pressure (SBP) in Group A was decreased to 132.58 mm Hg and in Group B it was 128.44 mm Hg, whereas at baseline it was 153.7 mm Hg and 153.9 mm Hg, respectively. After treatment, the average diastolic blood pressure dropped from 98.96 mm Hg to 82.4 mm Hg, a decrease of 97.14 mm Hg [11]. JJ NK et al., on 100 volunteers randomly divided into two groups and treated with amlodipine and Cilnidipine had mean SBP of 152.65 mm Hg and 153.01 mm Hg at baseline and 134.98 and 135.26 at 12 weeks. amlodipine and Cilnidipine groups had mean DBP of 99.84 and 99.70 at baseline and 87.88 and 88.26 at 12 weeks. Edema (16%), palpitations (10%), and giddiness (4%) were amlodipine side effects [12]. Sanada H et al. discovered mean SBP and DBP of 162.3 and 98.6 at baseline, 135.7 and 83.8 at 12 weeks, 131.0 and 82.2 at 24 weeks, and 125.0 and 78.4 at 53 weeks [13]. A study by Ihm SH et al., on benedipine effects on the blood pressure and arterial stress in the mild to moderate essential hypertension found a mean SBP 149.6 mm of HG in Benidipine and 147.6 mm of Hg in Losartan groups. The mean DBP was 96.9 and 95.9 in Benidipine and losartan groups respectively. the mean difference of SBP and DBP was statistically not significant ($p>0.05$).. According to Jadhav U et al., the mean SBP and mean DBP in the amlodipine group were 152.56, 144.7, 142.0, 138.0, and 126.8 and 95.7, 88.3, 87.1, 83.4, and 79.3 respectively. The mean SBP and mean DBP in the benidipine group were 152.6, 139.6, 131.9, 126.8, and 124.2 respectively at baseline, 1 month, 3 months, 6 months, and 12 months [14]. Studies have shown that amlodipine's vasodilatory impact raised resting heart rate, sympathetic activation, and reflex tachycardia, which all conventional dihydropyridine calcium channel blockers have [15,16]. Jj NK et al. found that amlodipine reduces 24-hour SBP and DBP in mild to moderate essential hypertension, and cilnidipine is a safe, effective alternative [13]. Benidipine reduces soluble E and P selectin in serum and platelets, which are clinically relevant indications of critical hypertension treatment hemodynamic effects [14]. Several studies found that Amlodipine reduced BP more effectively at lower doses. Amlodipine can remain a popular CCB despite newer calcium channel blockers [17-19]. Similarly, our study found a substantial mean difference in systolic and diastolic blood pressure between groups. Ankle edema proportions differed significantly across research groups. Low sample size and follow-up limit this investigation. Long-term follow-up studies with large participants are needed to evaluate several medication combinations for essential hypertension.

Conclusion

Amlodipine and benidipine are efficacious standalone antihypertensive drugs. However, the group treated with Benidipine showed a notable decrease in the average difference in systolic blood

pressure compared to the group treated with Amlodipine. Both groups exhibited constant levels of urine albumin and serum creatinine. Unlike amlodipine, Benedipine has a lower likelihood of causing ankle edema.

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