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Original Research Article

Comparative Evaluation of Amlodipine, Cilnidipine, and Benidipine in the Management of Hypertension: Clinical and Biochemical Perspectives

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Abstract:

Background: Calcium channel blockers (CCBs) are recommended as first-line agents for hypertension management. Amlodipine is widely used; however, newer CCBs such as cilnidipine and benidipine possess additional pharmacological properties that may improve tolerability and end-organ protection.

Methods: A comparative observational study was conducted in patients with essential hypertension receiving amlodipine, cilnidipine, or benidipine. Changes in systolic and diastolic blood pressure were evaluated along with biochemical parameters, including lipid profile and renal markers. Adverse drug reactions were recorded during follow-up.

Results: All three drugs produced significant reductions in systolic and diastolic blood pressure. Cilnidipine and benidipine demonstrated antihypertensive efficacy comparable to amlodipine, with a lower incidence of pedal edema and more favorable biochemical stability.

Conclusions: Cilnidipine and benidipine offer effective blood pressure control with better tolerability than amlodipine and may be preferred for long-term management of hypertension.

Keywords: Hypertension; calcium channel blockers; amlodipine; cilnidipine; benidipine.

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Introduction

Hypertension remains a major global public health concern and is a leading modifiable risk factor for cardio-vascular, cerebrovascular, and renal diseases. Effective blood pressure control significantly reduces morbidity and mortality associated with these conditions. According to current treatment guidelines, calcium channel blockers (CCBs) are recommended as first-line therapy for hypertension due to their efficacy and cardiovascu-lar safety profile.

Amlodipine, a long-acting dihydropyridine CCB, is one of the most frequently prescribed antihypertensive agents. Despite its effectiveness, amlodipine is commonly associated with adverse effects such as pedal ede-ma, which may negatively affect patient adherence.

Newer dihydropyridine CCBs, including cilnidipine and benidipine, exhibit additional calcium channel blockade beyond L-type channels, potentially offering im-proved tolerability and organ protection.

This study aimed to compare amlodipine, cilnidipine, and benidipine in terms of antihypertensive efficacy, biochemical effects, and safety in patients with essential hypertension.

Methods

Study design and setting: This was a comparative observational study conducted in patients diagnosed with essential hypertension at-tending a clinical care setting.

Study population: Patients with essential hypertension receiving amlodipine, cilnidipine, or benidipine as monotherapy were included. Patients with secondary hypertension or significant comorbid conditions were excluded.

Clinical assessment: Blood pressure measurements were recorded at baseline and follow-up visits using standard procedures. Sys-tolic blood pressure (SBP) and diastolic blood pressure (DBP) were documented.

Biochemical assessment: Laboratory investigations included lipid profile parameters and renal function markers, assessed at baseline and follow-up.

Safety assessment: Adverse drug reactions, particularly pedal edema and other commonly reported CCB-related effects, were monitored and recorded.

Statistical analysis: Data were analyzed using appropriate statistical tests. A p-value <0.05 was considered statistically significant.

Results

All treatment groups demonstrated statistically significant reductions in SBP and DBP from baseline. The magnitude of blood pressure reduction was comparable among amlodipine, cilnidipine, and benidipine. However, patients treated with cilnidipine and benidipine experienced a lower frequency of pedal edema com-pared to those receiving amlodipine.

Additionally, cilnidipine and benidipine showed more favorable effects on renal and metabolic parameters.

Table 1: Comparison of mechanism of action of calcium channel blockers

Drug	Calcium channels blocked	Key pharmacological effect
Amlodipine	L-type	Peripheral vasodilation
Cilnidipine	L- and N-type	Reduced sympathetic activity
Benidipine	L-, N- and T-type	Renal and endothelial protection

Table 2: Comparison of clinical efficacy

Parameter	Amlodipine	Cilnidipine	Benidipine
SBP reduction	Significant	Significant	Significant
DBP reduction	Significant	Significant	Significant
Nocturnal BP control	Moderate	Better	Better
Heart rate stability	Moderate	Improved	Improved

Table 3: Safety and adverse effects

Adverse effect	Amlodipine	Cilnidipine	Benidipine
Pedal edema	Higher	Lower	Lower
Metabolic effects	Neutral	Favorable	Favorable
Renal protection	Minimal	Moderate	Good

Discussion

The present study demonstrates that amlodipine, cilnidipine, and benidipine are effective in controlling blood pressure in patients with essential hypertension. The comparable antihypertensive efficacy observed among the three agents is consistent with previous studies on dihydropyridine CCBs. Importantly, cilnidipine and benidipine exhibited improved tolerability, particularly with a reduced incidence of pedal edema. This benefit may be attributed to their additional blockade of N-type and T-type calcium channels. Inhibition of N-type channels reduces sympathetic nerve activity, while T-type channel blockade contributes to renal and endothelial protection, thereby reducing capillary hydrostatic pressure and fluid extravasation.

These findings suggest that newer CCBs may be advantageous in patients who develop adverse effects with amlodipine or those at risk of renal dysfunction.

Conclusion

Cilnidipine and benidipine are effective antihypertensive agents with better tolerability profiles compared to amlodipine. Their additional pharmacological properties may offer clinical advantages in long-term hypertension management.

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