

Clinical Profile and Utilization Pattern of Antihypertensive Drugs in Geriatric Patients Admitted at Tertiary Care Hospital

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ABSTRACT

Background: Hypertension is a major health issue worldwide among geriatrics. Proper treatment and management of hypertension are essential to prevent cardiovascular complications. The primary challenges in managing hypertension in geriatrics include comorbidities, poly-pharmacy, decreased physiological function, and drug interactions. Therefore, the aim of our study is to assess the prescribing patterns of antihypertensive drugs in managing hypertension, as well as to evaluate the stages and clinical profiles of the patients. **Methodology:** This was a prospective cross-sectional study conducted on hypertensive geriatric patients admitted at tertiary care hospital. Ethical approval was obtained and 159 cases were enrolled based on the inclusion criteria over a period of 6 months. Details such as demographics, medical, medication, laboratory values were collected and subjected to statistical analysis. **Results:** Among the 159 Cases, higher incidence of hypertension was found in male 81(50.95%) patients. The majority of the patients belongs to the Category of age between 65-74 years (75.47%) and 54 (33.96%) patients are in pre-hypertensive stage. The lab investigation shows that, Higher the average value of GRBS (203.66mg/dl), creatinine (1.76 mg/dl) and abnormal ECG impressions were seen in 47 (69.1%) patients. The odds ratio for male smokers is 7.5, for male alcoholics is 3.64, and for patients with diabetes mellitus is 3.16. About 67 (42.13%) of patients are on mono-therapy and 68 (24.02%) patients consuming amlodipine as antihypertensive drug. Cardiovascular complications were observed in 43 (65.15%) patients. **Conclusion:** Our study concludes, the male patients have a higher incidence and majority of patients consuming amlodipine as a monotherapy. The clinical profile indicates that the mean values for GRBS, creatinine, and ECG results were abnormal. So, identification of risk factor, proper education, lifestyle changes and medication adherence help to optimize therapeutic outcomes and prevent complications.

Keywords: Hypertension, Geriatrics, Mono-therapy, Amlodipine, Odds ratio.

INTRODUCTION

Geriatrics refers to medical care for older adults and age is above 65 years¹. Hypertension is the major health problem worldwide. Elderly person with untreated hypertension is at high risk of suffering from cardiovascular events.² The higher the blood pressure, the greater the chances of myocardial infarction, heart failure, stroke and kidney disease.³ Until the age of 50-60 years, both systolic blood pressure and diastolic blood pressure increase with age that is more than 140/90mmhg as per European society of hypertension. Over the age of 60 years, in the majority of cases, systolic blood pressure increases with age, whereas diastolic blood pressure concomitantly remains stable or even decreases spontaneously⁴.

According to world health organization, in 2023 an estimated 1.28 billion adults worldwide have hypertension 54% of adults with hypertension are diagnosed, 42% receive treatment and a mere 21% have their hypertension control⁵. As per a study in the Journal of hypertension, in 2023 the prevalence of hypertension in India was 30%⁶. More than 1.3 billion people with hypertension globally, 82% live in low- and middle-income countries, and India alone is home to an estimated 220 million adults with hypertension⁷. The prevalence of hypertension increases with age making it a significant health concern for older persons. Aging involves a range of physiological changes such as increases in arterial stiffness, widening pulse pressure, changes in renin and aldosterone levels, decreases in renal salt excretion, declining in renal function, changes in the autonomic nervous system sensitivity and function and changes to endothelial function all of which may not only affect blood pressure but may also affect

individual response to pharmacotherapy used to manage hypertension and prevent end organ damage and other complications associated with poor blood pressure control⁸.

Younger men exhibited increased chest pain and heart palpitations, while younger women more commonly reported headaches and nausea/vomiting. A significant relationship was identified between pulse pressure (PP) and symptoms, with dizziness in women and chest pain/discomfort in men being most pronounced⁹

All patients with hypertension should have blood sampled, preferably while fasting, to measure creatinine and calculate the estimated glomerular filtration rate, urea, glucose, glycated hemoglobin A_{1c} (HbA_{1c}), serum electrolytes, lipid profile, thyroid function tests, liver function tests which helps to evaluate kidney, thyroid and liver function, the identification of dyslipidaemia, glucose intolerance, metabolic syndrome and cardiovascular risk stratification¹⁰

According to American college of cardiology/American heart association statement, lifestyle modifications may be all that is necessary to treat milder forms of hypertension in elderly patients.⁸ Lifestyle changes, including dietary modifications and increased physical activity, are effective in lowering BP and preventing hypertension and its cardiovascular diseases sequelae.¹¹ The dietary approaches to stop hypertension (DASH) diet is low in total and saturated fat, red meat, sugar, sugary drinks, and refined carbohydrates, but high in fruits, vegetables, whole grains, fish, poultry, and low-fat dairy products. The DASH diet has been found to lower weight, heart rate, risk of type 2 diabetes, C-reactive protein, Apo lipoprotein B, and homocysteine and is associated with a lower incidence of heart failure, all-cause mortality, and stroke¹².

Management strategies for hypertension in older adults must consider the degree of frailty, poly-pharmacy, cost effectiveness, drug interactions, increasingly complex medical comorbidities, and psychosocial factors, and must therefore be individualized.¹³ Common anti-hypertensive drugs, including diuretics, angiotensin-converting enzyme (ACE) inhibitors, calcium channel blockers, and even beta-blockers, have been shown to be effective in older adults. It is important to note that each commonly used drug class has additional benefit in the presence of different comorbidities, such as ACE inhibitors in diabetes mellitus and beta-blockers in coronary disease. Beta-blockers are inferior in benefits compared with other drug classes, but they may be used in selected cases in the elderly population.¹⁴ Failure to follow lifestyle modification, adequate antihypertensive drug dose or appropriate drug combination may result in inadequate blood pressure control.¹⁵

Many patients do not achieve their therapeutic goals for numerous reasons which can include poor disease insight and non-adherence. Pharmacists can be key players in controlling hypertension, given their medication knowledge and patient counselling skills, yet they remain an underutilized resource in the management of chronic disease states. Various models exist that allow pharmacists to provide direct patient-centered care but practices differ from state to state since pharmacists are not recognized nationally as healthcare providers¹⁶. So, the aim of our study is to assess the prescribing patterns of antihypertensive drugs in managing hypertension, as well as to evaluate the stages and clinical profiles among geriatric patients.

METHODOLOGY

Study Site:

This study was conducted in the department of general medicine among geriatric patients admitted for the management of hypertension in Siddaganga hospital.

Study Design:

This was a prospective Cross sectional study.

Study Population:

Geriatric patients who were suffered from hypertension and on antihypertensive medications. Their clinical profile and complications were obtained in the general medicine department at SMCRI, Tumkur.

Ethical Approval:

This study was undertaken after obtaining permission from Institutional Ethics Committee at Siddaganga Medical College and Research Institute (SMCRI).

Sample Size:

Sample size = $[Z1-\alpha/2]2p(1-p) d2$

(Where n= sample size, Z= 1.96, associated with 95% cl, D= 5%, absolute precision value, P= 11.7%, population proportion)

$n = ((1.96)^2 \times 0.117(1-0.117)) / (0.05)^2 = 158.7518 = 159$ patients.

The sample size was calculated by considering prevalence rate of hypertension parameter 11.7%¹⁷ and for margin of error 5% with 95% confidence interval, the minimum number of subjects required for the present study are 159 patients.

Inclusion Criteria:

- Hypertensive inpatients aged 65 years and above of either gender with or without co-morbidities.
- Hypertensive geriatric patients with clinical profile.

Exclusion Criteria:

- Intensive care unit patients having hypertension.
- Patients who are uncooperative or not willing to participate.
- Incomplete data.

Sampling Method:

Convenient sampling method

Method of Data Collection:

- Hypertensive patients who were admitted to Siddaganga Hospital and their data was collected by using a pre-designed profile form.
- The following information was collected: socio-demographic details such as name, age and sex along with the diagnosis.
- Details on the antihypertensive agents prescribed for the treatment of hypertension were obtained from inpatient case records.
- Signs, symptoms, and laboratory investigations such as electrolytes, liver function tests (LFT), and renal function tests (RFT) were assessed, as these parameters helped in determining the indications for specific medications in conditions such as chronic kidney disease (CKD) and liver abnormalities, given that the geriatric population is more prone to comorbidities.

Statistical Methods: The data was collected, compiled in MS-EXCEL. Descriptive statistics including, proportion/percentages, frequencies will be calculated. Graphical representation such as bar graph, pie chart and tables has been used for visual interpretation of the analysed data.

RESULTS:

This was a Prospective Cross-sectional study conducted for a period of 6 months in the department of general medicine of hypertensive patients admitted at Siddaganga hospital. A total of 159 patients were enrolled in our study based on inclusion Criteria. The demographic details such as age, sex, diagnosis along with information about past medical and medication history, current medical and treatment, laboratory investigations such as electrolytes, renal function Test, electrocardiogram/echocardiography, General Random Blood Sugar (GRBS) and blood pressure (BP) were collected by using a suitably pre-designed data collection form.

Totally, 159 patients were enrolled in our study. The numbers of male 81(50.95%) hypertensive patients were more when compared to number of females 78 (49.05%) hypertensive patients. In our study maximum number of hypertensive patients were found to be in the age group of 65-74 years 120 (75.47%), followed by the age group of 75-84 years 27(16.98%) and the minimum no of patients were in the age group above 85 years 12 (7.55%). The educational status among geriatric patients were obtained, among them 59 (37.1%) patients were educated and 100 (62.9%) were uneducated. In the area of residence, the 108 (67.92%) patients were from rural areas and 51(32.08%) patients were from urban areas. (Table 1).

Variable	Category	No. of Patients	In Percentage
Gender	Male	81	50.95%
	Female	78	49.05%
Age	65-74 years	120	75.47%
	75-84 years	27	16.98%
	≥85 years	12	7.55%

Educational status	Educated	59	37.1%
	Uneducated	100	62.9%
Area of residence	Rural	108	67.92%
	Urban	51	32.08%

Table 1: General Characteristics among Hypertensive Patients

Among 159 Hypertensive patients, 54 (33.96%) patients were found to be in the stage of pre-hypertension that is 120-139/80-90 mm Hg followed by 40 (25.16%) patients are in the stage of Stage-1 Hypertension that is 140-159/90-99 mm Hg, 35(22.01%) patients are in the Normal stage and 30 (18.87%) patients are in the Stage-3 Hypertension (Table 2).

Stages of Hypertension	Number of Patients	In Percentage
<120/80 mm Hg	35	22.01%
120-139/80-90 mm Hg	54	33.96%
140-159/90-99 mm Hg	40	25.16%
≥160/100 mm Hg	30	18.87%

Table 2: Stages of Hypertension

Different types of laboratory investigations were performed in hypertensive in-patients. Such as GRBS, RFT, electrolytes, ECG and ECHO. The mean value of GRBS was found to be 203.66 mg/dl, the mean serum creatinine level was 1.76 mg/dl, the mean urea level was 40.67 mg/dl, the mean uric acid level was 4.32 mg/dl, the mean sodium (Na⁺) level was 133.39 mmol/L, the mean potassium (K⁺) level was 4.30 mmol/L, and the mean chloride (Cl⁻) level was 104.46 mmol/L (Table 3).

Sl.No	Lab Investigations	Lowest Value	Highest Value	Average Value
1	GRBS (General Random blood sugar)	69 mg/dl	398 mg/dl	203.66 mg/dl
2	RFT (Renal function test) Serum Creatinine Urea Uric acid	0.4 mg/dl 10 mg/dl 0.7 mg/dl	11.9 mg/dl 118 mg/dl 8.9 mg/dl	1.76 mg/dl 40.67 mg/dl 4.32 mg/dl
3	Electrolytes Sodium (Na ⁺) Potassium (K ⁺) Chloride (Cl ⁻)	115 m mol/L 2.6 m mol/L 80 m mol/L	142 m mol/L 6.3 m mol/L 371 m mol/L	133.39 m mol/L 4.30 m mol/L 104.46 m mol/L

Table 3: Hypertension Related Lab Investigations

Among hypertensive patients, 68 patients were done with ECG and 42 patients were done with echocardiography (ECHO). The impression was found that, the maximum number of 47(69.1%) patients was having abnormal electrocardiogram (ECG), 17(25%) patients were having normal ECG and 4(5.8%) patients were having borderline ECG. The impression of ECHO based on left ventricular ejection fraction was found to be normal that is 50-70% for 29 (69.04%) patients, mild dysfunction that is 40-49% for 10 (23.80%) patients and moderate dysfunction that is 30-39% for 3(7.14%) patients (Table 4).

Investigations	Category	No of Patients	In Percentage
ECG	Normal	17	25%
	Borderline	4	5.8%
	Abnormal	47	69.1%
ECHO based on LVEF	50-70%	29	69.04%
	40-49%	10	23.80%
	30-39%	3	7.14%

Table 4: Details on Cardiac Related Investigations

The male patients of smokers had 7.5 times risk of getting hypertension than non-smokers; male alcoholic patients had 3.64 times risk of getting hypertension than non-alcoholic. In general, Diabetic mellitus patients are 3.16 times risk of getting hypertension than patients without Diabetic mellitus (Table 5).

SL. No	Population	Risk Factors	No. of Patients	Odds Ratio
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1.	Males	Smokers	59	7.5
		Non-Smokers	22	
2.	Males	Alcoholic	53	3.64
		Non-Alcoholic	28	
3.	General	Diabetic mellitus	102	3.16
		Without Diabetic mellitus	57	

Table 5: Details on Hypertension Risk Factors

Totally, 159 hypertensive patients were enrolled in our study. Among them 67(42.13%) patients were prescribed with monotherapy, 62(38.99%) patients were on dual therapy, 25(15.72%) patients were on triple therapy and 5 (3.14%) patients of them were prescribed with quadruple therapy (Table 6).

Sl.No	Therapy Pattern	No. of Patients	In Percentage
1	Mono Therapy	67	42.13%
2	Dual Therapy	62	38.99%
3	Triple Therapy	25	15.72%
4	Quadruple Therapy	5	3.14%

Table 6: Therapy Pattern in Hypertensive Patients

Out of 159 patients, 21(31.34%) patients were commonly prescribed with Amlodipine as a monotherapy, 18(29.03%) patients were commonly prescribed with Telmisartan + Amlodipine as a dual therapy, 4(16%) patients were commonly prescribed with Sacubutril + Valsartan + Torsemide as a triple therapy and 2(40%) patients were commonly prescribed with Torsemide + Spironolactone, Telmisartan + Metoprolol succinate as a quadruple therapy (Table 7).

Sl. No	Usage Pattern	Drugs	No. of Patients	In Percentage
1	Monotherapy	Amlodipine	21	31.34%
		Furosemide	20	29.85%
		Telmisartan	12	17.91%
		Metoprolol succinate	5	7.46%
		Bisoprolol fumerate	4	5.97%
		Olmesartan	2	2.98%
		Cilnidipine	1	1.49%
		Enalapril maleate	1	1.49%
		Prazosin hydrochloride	1	1.49%
2	Dual therapy	Telmisartan+Amlodipine	18	29.03%
		Telmisartan+Hydrochlorothiazide	11	17.74%
		Furosemide+Amlodipine	6	9.67%
		Metoprolol succinate+Amlodipine	5	8.06%
		Telmisartan+clinidipine	3	4.83%
		Amlodipine+Atenolol	2	3.22%
		Furosemide+spironolactone	2	3.22%
		Metoprolol succinate+cilnidipine	2	3.22%
		Metoprolol+Telmisartan	2	3.22%
		Nifedipine+Amlodipine	2	3.22%
		Amlodipine+losartan	1	1.61%
		Bisoprolol fumerate+Torsemide	1	1.61%
		Enalapril maleate+Amlodipine	1	1.61%
		Furosemide+Bisoprolol fumerate	1	1.61%
		Furosemide+Cilnidipine	1	1.61%
		Furosemide+Telmisartan	1	1.61%
		Metoprolol succinate+Losartan	1	1.61%
		Olmesartan medoxomil+Hydrochlorothiazide	1	1.61%
		Torsemide+Amlodipine	1	1.61%

3	Triple therapy	Sacubutril+Valsartan+Torsemide	4	16%
		Furosemide+Amlodipine+Metoprolol succinate	3	12%
		Telmisartan+Amlodipine+Atenolol	2	8%
		Metoprolol succinate+Cilnidipine+Clonidine	2	8%
		Furosemide+Cilnidipine+Metoprolol succinate	2	8%
		Furosemide+Bisoprolol fumerate+Ramipril	2	8%
		Amlodipine+Enalapril maleate+Telmisartan	2	8%
		Torsemide+Telmisartan+Amlodipine	1	4%
		Telmisartan+Hydrochlorothiazide+Amlodipine	1	4%
		Telmisartan+Amlodipine+Torsemide	1	4%
		Furosemide+Telmisartan+Hydrochlorothiazide	1	4%
		Furosemide+Telmisartan+Cilnidipine	1	4%
		Furosemide+Olmesartan+Amlodipine	1	4%
		Furosemide+Bisoprolol fumerate+Cilnidipine	1	4%
		Furosemide+Bisoprolol fumerate+Amlodipine	1	4%
4	Quadruple therapy	Torsemide+Spironolactone,Telmisartan+Metoprolol succinate	2	40%
		Amlodipine+Clonidine+Prazosin+Bisoprolol fumerate	1	20%
		Furosemide+Bisoprolol fumerate+Telmisartan+Cilnidipine	1	20%
		Sacubutril+Valsartan+Torsemide+Amlodipine	1	20%

Table 7: Details on Antihypertensive Drug Usage Pattern

In our study, it was found that the most preferred class of antihypertensive drugs was found to be Calcium channel blockers (CCBs) for 84 (29.68%) patients followed by Diuretics for 73 (25.79%) patients, Angiotensin II Receptor Blocker (ARB) for 70 (24.73%) patients, Beta-Blocker for 40 (14.13%) patients, Angiotensin Converting Enzyme (ACE) Inhibitor for 6 (2.12%) patients, Angiotensin Receptor Neprilysin Inhibitor (ARNI) for 5 (1.76%) patients, Centrally acting Alpha (α)-Agonist for 3 (1.06%) patients and Alpha (α) Blocker for 2 (0.7%) patients (Table 8).

Sl. No	Class of Antihypertensives	No. of Patients	In Percentage
1.	Calcium channel blockers	84	29.68%
2.	Diuretics	73	25.79%
3.	Angiotensin II Receptor Blocker (ARB)	70	24.73%
4.	Beta-Blocker	40	14.13%
5.	Angiotensin Converting Enzyme (ACE) Inhibitor	6	2.12%
6.	Angiotensin Receptor Neprilysin Inhibitor (ARNI)	5	1.76%
7.	Centrally acting Alpha (α)-Agonist	3	1.06%
8.	Alpha(α) Blocker	2	0.7%

Table 8: Preferred Class of Antihypertensive drugs

The most prescribed individual drug in our study was found to be Amlodipine for 68 (24.02%) patients followed by Telmisartan for 59 (20.84%) patients, Furosemide for 44 (15.54%) patients, Metoprolol succinate for 24 (8.48%) patients, Cilnidipine and Hydrochlorothiazide for 14 (4.94%) patients, Bisoprolol fumerate for 12 (4.24%) patients, Torsemide for 11 (3.88%) patients, Valsartan and Sacubutril for 5 (1.76%) patients, Spironolactone, Olmesartan, Atenolol and Enalapril maleate for 4 (1.41%) patients, Clonidine for 3 (1.06%) patients and Nifedipine, Prazosin hydrochloride, Losartan, Ramipril for 2 (0.7%) patients (Table 9).

Sl.No	Medications	No. of Patients	In Percentage
1.	Amlodipine	68	24.02%
2.	Telmisartan	59	20.84%
3.	Furosemide	44	15.54%
4.	Metoprolol succinate	24	8.48%
5.	Cilnidipine	14	4.94%
6.	Hydrochlorothiazide	14	4.94%

7.	Bisoprolol fumerate	12	4.24%
8.	Torsemide	11	3.88%
9.	Valsartan	5	1.76%
10.	Sacubutril	5	1.76%
11.	Spironolactone	4	1.41%
12.	Olmesartan	4	1.41%
13.	Atenolol	4	1.41%
14.	Enalapril maleate	4	1.41%
15.	Clonidine	3	1.06%
16.	Nifedipine	2	0.7%
17.	Prazosin hydrochloride	2	0.7%
18.	Losartan	2	0.7%
19.	Ramipril	2	0.7%

Table 9: Individualization usage of Antihypertensives

Out of 159 hypertensive patients, 66 (41.50%) patients had complications. Among these, cardiovascular disease (CVD) accounted for 43 (65.15%) patients, followed by chronic kidney disease in 17 (25.75%) patients, and both cardiovascular disease and chronic kidney disease (CKD) in 6 (9.1%) patients (Table 10).

Sl. No	Complications	No. of Patients	In Percentage
1.	CVD	43	65.15%
2.	CKD	17	25.75%
3.	CKD+CVD	6	9.1%

Table 10: Complications of Hypertension

DISCUSSION

A Total 159 patients were enrolled in our study. The numbers of male 81(50.94%) hypertensive patients were more when compared to number of females 78 (49.05%) hypertensive patients. The maximum no of hypertensive patients was found to be in the age group of 65-74 years and during our study period 54 (33.96%) patients were found to be in the stage of pre-hypertension that is 120-139/80-90 mm Hg. These results are similar to the study conducted by Arshad H Mohammed et al., indicating that males' geriatric patients are higher at risk due to age-related susceptibility, gender specific life style habits such as smoking, alcohol, metabolic comorbidities and kidney function impairment. Most hypertensive patients initially presented in the pre-hypertension stage, indicating that the medications they were taking were providing good therapeutic effect¹⁸. Majority of patients were uneducated and they are from rural areas. The values of RFT such as serum creatinine, blood urea and serum uric acid was found to be higher in hypertensive patients. This is similar to the study performed by Dr. Rakhee Yadav et al., these results highlight the importance of routine RFT monitoring because hypertension is a major risk factor for renal impairment, this test help for the early detection, timely intervention and potentially prevent the progression to chronic kidney disease¹⁹.

The male patients of smokers had 7.5 times risk of getting hypertension than non-smokers this is similar to the study demonstrated by Anri et al., indicating that effect of smoking on incidence of hypertension²⁰ in elderly because chronic smoking causes arterial stiffness which further aggregates the hypertension. male alcoholic patients had 3.64 times risk of getting hypertension than non-alcoholic this result is similar to the study conducted by Howard D Sesso et al., indicating that there is consistent dose dependent relationship between alcohol intake and blood pressure and heavy drinking can cause weight gain in the elderly which further increases the risk of cardiovascular diseases²¹. Diabetic mellitus patients are 3.16 times risk of getting hypertension than patients without Diabetic mellitus this result is linked to the study performed by B C Unadike et al., the insulin resistance, consistent high blood sugar level and its microvascular changes can impair renal function thus contributing to the risk of hypertension suggesting that hypertension is prevalent in person with DM²².

During our study period the most preferred class of antihypertensive drugs was found to be Calcium channel blockers for 84 (29.68%) patients and 67 (42.13%) patients were prescribed with monotherapy, this aligns with the standard guidelines which suggest starting with the single drug especially in mild to moderate cases to minimize side effects and also to improve the adherence to the medications 62

(38.99%) patients were on dual therapy, These results are similar to the study conducted by Ka Keat Lim et al., this describes the prescribed therapy was effective in geriatrics²³. The most prescribed individual drug in our study was found to be Amlodipine for 68 (24.02%) patients This result was similar to the study conducted by Arshad H Mohammed et al., indicating that amlodipine is drug of choice among CCB due to its once daily-dosing, long duration of action and good safety profile in the elderly¹⁸. Moreover, in elder adults with comorbid conditions like peripheral vascular disease or angina, CCBs offer the additional benefit of improving cardiovascular outcomes.

Overall, the prescribing trends observed in our study highlight a rational, evidence-based approach to management of hypertension in geriatrics.

CONCLUSION

Our study concludes that, male patients are more suffering from hypertension and they were in the age group between 65-74 years. Maximum of patients are in pre-hypertensive stage and receiving monotherapy. Calcium channel blocker class of antihypertensive drug were most preferred class of drug and individual drug Amlodipine is commonly used in the management of hypertension. In Clinical profile of hypertension GRBS, serum creatinine and ECG was found to be abnormal. In male patients, smoking and alcohol consumption are major risk factors. Diabetes mellitus is a significant general risk factor, and cardiovascular diseases are commonly associated with hypertension in geriatric patients. So, identification of risk factors, patient education about DASH therapy, counselling on lifestyle modifications, Medication adherence helps to increase therapeutic outcomes and prevent complications. Finally, which reduces the morbidity and mortality rate among hypertensive patients.

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Conflict Of Interest

The authors declare no conflict of interest.

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