



Comparison of prescription patterns of antihypertensives in the geriatric population with JNC 8 guidelines

Kousalya Prabahar* 

Department of Pharmacy Practice, Faculty of Pharmacy, University of Tabuk, Tabuk, Saudi Arabia.

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ABSTRACT

In the management of hypertensive patients, variations in the treatment from the standard guidelines could be observed. Irrationality in the prescribing pattern may cause serious health issues, as well as increased treatment cost. The objective of the study was to assess the current prescribing patterns of antihypertensives in the geriatric population and to compare the prescription pattern with the standard treatment guidelines of the Joint National Committee (JNC 8). A prospective observational study was conducted in a general medicine unit of a tertiary care hospital for a period of 5 months, using a structured proforma. Four hundred cases were collected. As per JNC 8, calcium channel blockers (88%) were found to be most commonly prescribed, which was in accordance with the JNC 8 treatment algorithm. The second most commonly prescribed drug was beta blockers (BBs) in our study, but BBs were not a preferred therapy according to the guidelines. With regard to comorbidities, according to the JNC 8 guidelines, the treatment of choice for diabetes was angiotensin-converting enzyme inhibitors/angiotensin-receptor blockers, calcium channel blockers (CCBs), and diuretics. But in our study, CCBs, BBs, and diuretics were given. There was 27.5% deviation from the JNC 8 guidelines. Optimizing the treatment pattern in accordance with standard treatment guidelines will decrease the risk of complications.

INTRODUCTION

An increase in systolic or diastolic blood pressure is called hypertension (HTN). According to JNC 8, systolic blood pressure greater than 140 mmHg and diastolic blood pressure greater than 90 mmHg is classified as HTN (James *et al.*, 2014). HTN leads to many diseases mainly angina, ischemic attack, and stroke. Various complications arise because of HTN (Cubriilo-Turek, 2003; Reshma *et al.*, 2012). Persons with high blood pressure are at a higher risk of developing cardiovascular diseases when compared to the general population (Fuchs and Whelton, 2020).

Increased blood pressure is a major risk factor, which is a reason for death across the world (Lawes *et al.*, 2008). In 2000, one billion adults had HTN, and this will rise to 1.56 billion by the end of 2025 (Mills *et al.*, 2016). Several studies have reported

that the prevalence of HTN is rapidly increasing in developing countries (Singh *et al.*, 2017).

Indian scenario of HTN

The overall prevalence of HTN in India is about 29.8% (33.8% - urban; 27.6% - rural). A systematic review reported that there is an increase in the prevalence of HTN in the rural and urban population (Anchala *et al.*, 2014).

Even though non-pharmacological therapies are efficient in reducing blood pressure, people usually do not follow it regularly. Also, majority of the people have high BP, despite non-pharmacological therapy. In these situations, pharmacological therapy would be appropriate (Gupta and Guptha, 2010).

There is a great variation in the prevalence of HTN between developed countries and developing countries. It has been greatly increased in the urban and rural population, especially in India, and the rate is more in urban population (Das *et al.*, 2005). Different studies have reported varying proportions of uncontrolled HTN in adults in India (23.4%–89%) (Gupta *et al.*, 2012; Nagappa *et al.*, 2018; Sumit *et al.*, 2012). But the geriatric population is more prone to be affected by HTN. Men are more

*Corresponding Author
Kousalya Prabahar, Department of Pharmacy Practice,
Faculty of Pharmacy, University of Tabuk, Tabuk, Saudi Arabia.
E-mail: kgopal@ut.edu.sa

affected when compared to women. There is a positive correlation between their age and HTN. Timely and rational management of HTN is essential to reduce the complications of HTN (Lionakis *et al.*, 2012). Uncontrolled HTN leads to various complications, and the incidence of stroke (57%) and coronary artery disease (CAD)-related deaths (24%) are more with uncontrolled HTN (Ramakrishnan *et al.*, 2019).

Several guidelines for HTN are available around the world. For example, the International Society of HTN Global HTN Practice Guidelines, Eighth Report of the Joint National Committee (JNC 8) guidelines, Canadian recommendations for the management of HTN, and the British HTN Society guidelines for HTN management (Hernandez-Vila, 2015). The JNC 8 guidelines provide a stepwise algorithm for the therapeutic management. This guideline algorithm provides easy understanding at a glance. It also directs and assists the physicians during their therapeutic approach. The guidelines' main goal is to achieve the target blood pressure and hence to reduce the complications. But still there are variations in the choice of antihypertensives among different guidelines (Arshad *et al.*, 2021). According to the JNC 8 guidelines, the initial drugs of choice for HTN are angiotensin-converting enzyme inhibitors (ACEIs), angiotensin-receptor blockers (ARB), thiazide diuretics, and calcium channel blockers (CCBs) (James *et al.*, 2014).

The patient's demographic and clinical characteristics should be thoroughly assessed by the physicians, before determining effective treatment. The practice patterns of physicians must adhere to the guidelines for effective outcome of therapy (Buang *et al.*, 2019). The practice pattern and the attitude of physicians also play a major role in the effective management of HTN. In routine practice, the choice of antihypertensives is usually neglected (Burnier and Egan, 2019). There is strong evidence that irrational antihypertensive prescription will lead to increased healthcare costs to both individual patients and society as a whole. Hence, it is essential to study the prescription pattern and its adherence to the guidelines to minimize the cost and to prevent irrational prescribing (Jain *et al.*, 2015). Special care must be taken especially for the geriatric population since they are a high-risk population group.

A study on prescribing patterns of antihypertensives in geriatric patients was conducted and it reported that the most commonly prescribed drug classes involved were CCBs, followed by angiotensin II receptor antagonists (Mohd *et al.*, 2012). The authors also added that this practice had a positive impact on controlling blood pressure. Prescribing patterns of antihypertensive drugs in the geriatric population in tertiary care hospital was studied and the most commonly prescribed monotherapy was CCBs (amlodipine), followed by ARBs (telmisartan) (Philip *et al.*, 2016). There were very few studies analyzing the prescribing pattern of antihypertensives in geriatric patients. Moreover, studies which compare the same with the JNC 8 treatment guidelines were lacking.

Hence, this study was conducted with the objective of assessing the current prescribing pattern of antihypertensives in the geriatric population and to compare the prescription pattern with the JNC 8 guidelines.

MATERIALS AND METHODS

A prospective observational study was conducted in the general medicine unit of a tertiary care hospital, for 5 months. Convenience sampling technique was used to select the study sample. The sample size was calculated based on the number of patients visiting the general medicine unit of the hospital during the 5-month study period, considering a dropout of 20%. Ethical approval was obtained from Institutional Ethics Committee, Vels University, before conducting this study (IEC/2019/I/15). Patients of either sex above 65 years, diagnosed as hypertensive as per the JNC 8 guidelines, and patients receiving or prescribed with antihypertensive drugs were included. The patients who were not willing to participate in the study were excluded. Four hundred patients were included in the study. The demographics of the patients, clinical and laboratory findings, and the therapeutic details were collected.

Data collection

The patients who visited the outpatient department of the general medicine unit, who were diagnosed to be hypertensive, were reviewed. The hypertensive patients who met the inclusion criteria were included in the study. The blood pressure at the time of inclusion in the study was taken. The patients' demographic characteristics, their antihypertensive medication prescribed and its characteristics (name of medication, class, dose, and frequency), and socio-demographic status were also documented in a data collection form designed for the study. The antihypertensive medications used to treat the patients were then analyzed and compared with the JNC 8 treatment guidelines. The guidelines clearly explain the initial choice of drugs for HTN, treatment choice for various comorbidities, and the agents of choice in each class of medications. The drugs prescribed for the study population were compared with the guidelines based on the drugs of choice, dose, frequency, and comorbidities.

Data analysis

Data were entered and analyzed by Statistical Package for the Social Sciences version 21.0 and expressed as number and percentage.

RESULTS AND DISCUSSION

Our study aimed at finding out the anti-HTN prescription patterns, comparing it with the standard treatment guidelines (JNC 8) and the extent of deviation, comparing the medications used in the treatment of HTN.

Four hundred patients were included for the study. With regard to the demographic data, majority of our study population were male, most patients were from 66 to 70 years, many had normal body mass index (BMI), majority had a family history of HTN, most of the elderly were smokers and alcoholics, and majority were of stage-II HTN.

There was an increase in males (53%) compared to females (47%). Other studies revealed the same results (Chandra *et al.*, 2019; Mohd *et al.*, 2012; Philip *et al.*, 2016; Sharma *et al.*, 2018). Majority were in the age group of 66–70 years (87%). This was similar to another study (Mohd *et al.*, 2012).

Of the 400 patients evaluated, 252 (63%) patients were found with normal BMI, 96 (24%) patients were obese, and 52 (13%) patients were underweight. 85% (40% male and 45% female) of the patients had a family history of HTN. In this study, 76 (19%) patients were smokers and 136 (34%) patients were smokers + alcoholics.

Hypertensive patients were categorized based on the JNC 8 as depicted in Table 1. Of the 400 patients evaluated, 240 (60%) patients were in stage II. This was in contrast to another study in which majority of the patients were in pre-hypertensive stage (Pavani *et al.*, 2012). This could be due to variations in the study site and study population.

The most commonly prescribed drug classification was CCBs (88%), followed by beta blockers (BBs) (65%) (Table 2). This was in accordance with the study conducted by Mohd *et al.* (2012), in which the commonly prescribed drug was CCBs, whereas the second commonly prescribed drug was ARBs.

Table 3 depicts the drugs prescribed based on the age group. CCBs (88%) were found to be most prescribed drugs for all the age groups.

Among the CCB, amlodipine 5–10 mg was the most prescribed drug. These results are comparable with other study results (Almas *et al.*, 2011; Datta and Sharma, 2010; Datta, 2011; Neal *et al.*, 2000). Atenolol was commonly prescribed among BB, enalapril among ACEI, and hydrochlorothiazide (HCTZ) among thiazide diuretics.

Table 1. Stages of HTN based on JNC 8 guidelines.

Classification	Male		Female		Total	
	n	%	n	%	n	%
Pre-HTN	8	2	12	3	20	5
Stage-I	72	18	68	17	140	35
Stage-II	132	33	108	27	240	60

Table 2. Drugs prescribed based on gender.

Drug classification	Male		Female		Total	
	n	%	n	%	n	%
CCB	192	48	160	40	352	88
BB	120	30	140	35	260	65
ACEI	124	31	96	24	220	55
Thiazide diuretics	56	14	56	14	112	28

CCB = Calcium channel blocker; BB = Beta blocker; ACEI = Angiotensin-converting enzyme inhibitor.

Table 3. Drugs prescribed based on age group.

Drug classification	Age group (years)										Total	
	66–70		71–75		76–80		81–85		86–90			
	n	%	n	%	n	%	n	%	n	%	n	%
CCB	308	77	32	8	8	2	4	1	0	0	352	88
BB	224	56	24	6	12	3	0	0	0	0	260	65
ACEI	192	48	12	3	8	2	4	1	4	1	220	55
Thiazide diuretics	92	23	8	2	8	2	0	0	4	1	112	28

CCB = Calcium channel blocker; BB = Beta blocker; ACEI = Angiotensin-converting enzyme inhibitor.

Monotherapy was prescribed for 2% of the patients, dual therapy for 78%, triple therapy for 15%, and quadruple therapy for 5% of the patients. Amlodipine was the only monotherapy prescribed. Among the dual therapy, atenolol + amlodipine was commonly prescribed. This was not in accordance with other studies (Datta, 2011; Datta and Sharma, 2010) in which diuretics was used in combination with other agents. The study population, the study site, and the prescribing physician change the results considerably. Atenolol + HCTZ + amlodipine were commonly prescribed among the triple therapy and atenolol + HCTZ + amlodipine + enalapril among the quadruple therapy (Table 4). Males were commonly prescribed with combination drug therapy than females.

Anti-HTN prescribing patterns were classified into HTN with comorbidities (27%) and HTN without comorbidities (73%). This was similar to the study conducted by Philip *et al.* (2016). The use of antihypertensive drugs in HTN with comorbidities is summarized in Table 5.

Table 4. Various drug combinations prescribed based on gender.

Combination drugs	Male		Female		Total	
	n	%	n	%	n	%
Amlodipine	4	1	4	1	8	2
Atenolol + amlodipine	96	24	80	20	176	44
HCTZ + atenolol	36	9	24	6	60	15
HCTZ + amlodipine	40	10	36	9	76	19
Atenolol + HCTZ + amlodipine	20	5	12	3	32	8
Atenolol + enalapril + amlodipine	16	4	12	3	28	7
Atenolol + HCTZ + amlodipine + enalapril	12	3	8	2	20	5

HCTZ = hydrochlorothiazide.

Table 5. Use of antihypertensive drugs for HTN with comorbidities.

Comorbidities	Drugs	Number n (percentage %)
DM	Amlodipine	4 (1)
	Atenolol + amlodipine	36 (9)
	HCTZ + amlodipine	32 (8)
CAD	Atenolol + amlodipine	8 (2)
	Atenolol + enalapril + amlodipine	20 (5)
	Atenolol + HCTZ + amlodipine + enalapril	8 (2)

HCTZ = hydrochlorothiazide.

Diabetes mellitus (DM) was the common comorbidity found in majority of the population. This was similar to a study conducted by *Mohd et al. (2012)*.

According to the JNC 8 guidelines, the initial drugs of choice for HTN are ACEI, ARBs, thiazide diuretic, or CCBs. Our study population was prescribed commonly with CCBs, which was in accordance with the JNC 8 treatment algorithm. The second most commonly prescribed drug was BBs in our study, but BBs were not a preferred therapy according to the guidelines (*James et al., 2014*).

Among the CCBs, amlodipine was the mostly prescribed drug, atenolol among BBs, enalapril among ACEIs, and hydrochlorothiazide among thiazide diuretics. CCBs and diuretics were prescribed according to the JNC 8 guidelines, whereas among ACEIs, the agents of choice were lisinopril, benazepril, fosinopril, quinapril, ramipril, and trandolapril. Among BBs, the agents of choice were metoprolol, nebivolol, propranolol, carvedilol, bisoprolol, and labetalol (*Nguyen et al., 2012*).

With regard to comorbidities, according to the JNC 8 guidelines, the treatment of choice for diabetes was ACEI/ARBs, CCBs, and diuretics. But in our study, CCBs, BBs, and diuretics were given. This is similar to the study conducted by *Philip et al. (2016)*, in which amlodipine, a CCB was commonly prescribed. ACEIs were not prescribed and BBs which was not mentioned in the algorithm was prescribed. The treatment of choice for CAD, according to the JNC 8 guidelines, was ACEI, BB, diuretic, and CCB. The same was prescribed in our study also and in another study (*Kaiser et al., 2014*). There was no deviation in the dose or frequency from the guidelines.

Overall, BBs were prescribed for 260 patients, in combination therapy for patients with or without comorbidities. Also among the BBs, metoprolol was the choice of drug as per the JNC 8. But in our study, atenolol was commonly prescribed among BBs, which was not in accordance with the JNC 8 guidelines. There was 27.5% deviation from the JNC 8 guidelines. The reason for this deviation could be that this study was conducted in a government hospital, where drugs were given free of cost. Drugs with lesser costs would have been preferred in this hospital.

Limitations of the study

Since this was a prospective observational study, the clinical outcome could not be assessed. Moreover, since this study was carried out in a government hospital, where drugs were given free of cost, the healthcare cost assessment was not carried out.

Future directions

- Multicentric studies should be conducted in a large population.
- Follow-up should be carried out to assess the clinical outcome.
- Healthcare costs should be analyzed.

CONCLUSION

Our study population was prescribed mostly with dual drug therapy combination in which BBs and CCBs were mostly used. But according to the JNC 8 guidelines, BBs are not among the initial recommended drug classes. The treatment pattern in hypertensive patients was deviated, which can lead to other

complications. Optimizing the treatment pattern in accordance with standard treatment guidelines will decrease the risk of complications. But other factors, like patient's preference and side effects, may have an influence on the selection of drugs.

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AUTHOR CONTRIBUTIONS

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

The authors do not have any conflicts of interest.

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