

## A prospective observational study on drug utilization evaluation of antihypertensives in a tertiary care hospital

DURGA PRASAD THAMMISSETTY \*, E THULASI M. HARI DEEPIKA and M HEMANTH YADHAV

*Department of Pharmacy Practice, Sri Padmavathi School of Pharmacy, Tirupati, Andhra Pradesh, India.*

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### Abstract

**Background:** Since hypertension plays a part in the development of major cardiovascular disorders and renal diseases, it is considered a serious health issue. To guarantee safe and effective treatment, a periodic evaluation of the drug utilization pattern in a tertiary care teaching hospital necessitates a study on antihypertensive consumption.

**Objective:** To determine drug utilization evaluation of antihypertensives in the inpatient department at the tertiary care hospital.

**Method:** It was a prospective observational study carried out at department of medicine, Sri Venkateswara Ramnaraian Ruia (SVRR) Government General Hospital, Tirupati, over a period of 6 months (September 2023 to February 2024). A total 150 patients were included for study and were assessed by patient treatment chart, patient past history, patient laboratory data and patient interview.

**Results:** 150 patients of which 57% were males and 43% were females, out of them 62% were prescribed monotherapy antihypertensives, 29% with two-drug therapy, and 9% were prescribed with three-drug therapy. Among that 72% were receiving CCB, 20% with BB, 7% with ARB, and 1% with ACEI. In this investigation, significant variations in the use of various antihypertensive drug groups were found.

**Conclusion:** These studies provide a general overview of the antihypertensive medicine prescription pattern and rational drug use

**Keywords:** Hypertension; Antihypertensive; Systolic blood pressure; Diastolic blood pressure

### 1. Introduction

Hypertension, often known as high blood pressure, is defined as a persistently elevated systolic blood pressure of 140 mm Hg or higher and/or a diastolic blood pressure of 90 mm Hg or higher. cardiovascular, cerebrovascular, or renal diseases can increase the risk of morbidity and mortality from untreated or insufficiently controlled hypertension. It was shown that the following factors were significant independent predictors of hypertension: drinking, smoking, being older, and male gender. Many drugs are required by most hypertensive patients in order to attain ideal blood pressure control. Expert panels recommend adopting combination treatments using two or more medications to treat patients who are at high risk, have higher blood pressure. However, the use of many medications lowers patient compliance. Patients on fixed-dose combination therapy are able to achieve the target blood pressure because of improved patient compliance.<sup>1</sup>

\* Corresponding author: DURGA PRASAD THAMMISSETTY

With the ultimate goal of improving medication-related outcomes for a group of patients or consumers, a Drug Use Evaluation (DUE) or Medication Use Evaluation (MUE) program is a planned, criteria-based, systematic procedure for tracking, assessing, and continuously improving medication use. Every venue where pharmacological care is given can benefit from the MUE improvement approach. Because of their background in pharmaceutical care, pharmacists are integral to a DUE program's general operation. This gives pharmacists the chance to spot patterns in patient prescriptions, such as those for people with diabetes, asthma, or high blood pressure. The pharmacist then takes the necessary steps to enhance the drug therapy in collaboration with the doctor and other medical teams.<sup>3</sup> Given the rising prevalence of hypertension, the growing number of new antihypertensive medications, the growing number of drug combinations that are brought to market annually, and changes in guidelines, it is imperative that antihypertensive prescribing patterns be regularly evaluated. The goal of the current study is to examine the patterns of antihypertensive medication use in tertiary care hospitals.<sup>4</sup>

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## 2. Material and methods

Iwast a Prospective observational study carried at department of medicine of Sri Venkateswara Ramnaraian Ruia (SVRR) Government General Hospital, Tirupati, over a period of 6 months(September 2023 to February 2024). It is an a tertiary care teaching hospital.The study was approved by the institutional ethical committee with proposal no: SPSP/2023- 2024/PD05. the study was conducted guidelines in accordance with the ethical principles of the ethical committee .

### 2.1. Study population

Inpatients of either gender aged  $\geq 18$  years with denovohypertention, know case of Hypertension with comorbidities and Patients receiving antihypertensive drugs were outlined as the main criteria for the inclusion of the patient prescription to the study sample. Patients attending outpatient department and patients with gestational hypertension, Psychiatric patients, Pulmonary and portal hypertension patients were excluded from the study.Upon applying the inclusion and exclusion criteria, a sample of n = 150 patient charts was considered for the analysis

### 2.2. Method of Data collection:

Study participants were identified and selected based on inclusion and exclusion criteria in inpatient of general medicine wards were reviewed on daily basis. All of these individuals' medication information was gathered and entered into a data collection form. The information gathered from research participants includes

- Sociodemographic information on the patient, including age, sex, weight, etc.
- Disease specific information like past medical history, reason for admission, allergies, Risk factors and Co-morbidities.
- Medication history including drug administered, route of administration, dose, dosage, drugs involved in type of drug related problems, reason for intervention, suggestion made by student pharmacist.
- The patient charts were assessed for obtaining the prescribing pattern, rationality, drug related Problems including adverse drug reaction, drug interaction, failure to receive drug and drug use without indication using Micromedex and JNC 8 guidelines. Statistical techniques were used to examine the effectiveness of hypertension medications.

### 2.3. Statistical analysis

The statistical analyses were conducted using the software R programming. Difference between means of two groups were compared using a paired t test and a p-value below 0.05 was deemed statistically significant.

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## 3. Results

### 3.1. Gender wise distribution of study population

Out of 150 patients, males share a larger proportion 85(57%) than females 65(43%)

### 3.2. Age-wise distribution of the study populations

Out of 150 patients, the majority of patients were under the age group of 60-69 years contributing 43(29%), followed by 70-79 years with 36(24%) patients and 20-29 years with 3(2%).

### 3.3. Distribution of the study population based on stages of hypertension according to JNC VIII

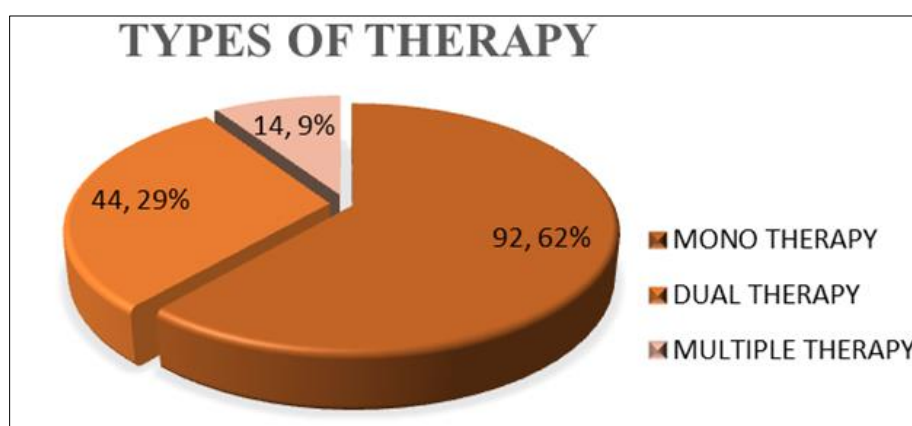
Out of 150 study population, 66(44%) patients had prehypertension followed by 46(31%) patients had stage I hypertension.

### 3.4. Distribution of the study population based on risk factors

Among the study populations, the majority of patients 127(45%) were in the above 50 age group, 60(21%) patients had no physical activity, and 2(1%) patients chewed tobacco.

### 3.5. Distribution of the study population based on complications

Among 86 (57.33%) patients with complications, 70 (81.39%) patients had single complications remaining 16(18.61%) had multiple complications. Among 70 (81.39%) patients who had single complications, the majority of patients 47(67.14%) were affected with CKD, 10 (14.29%) were affected with stroke, lowest patients 1(1.43%) were affected with HRS. Among 16(18.61%) patients who had multiple complications, the majority of patients 7 (43.75%) were affected with CKD and HF



**Figure 1** Distribution of the study population based on THPE of therapy

Out of 150 patients 92(62%) patients were with mono therapy, 44(29%) patients were with dual therapy and 14(9%) patients were with multiple therapy

### 3.6. Distribution of the study population based on mono therapy

among 92(62%) patients who had mono therapy, the most of patients 54(59%) Were prescribed amlodipine, 12(13%) were prescribed both cilnidipine and metoprolol, 6(7%) were prescribed telmisartan, 4(4%) were prescribed atenolol, 3(3%) were prescribed propranolol and one patient was using enalapril.

### 3.7. Distribution of the study population based on dual therapy

Among 44(29%) who have had dual therapy, the majority of patients 12 (27%) were prescribed CCB & ARB, followed by 11 (26%) patients were prescribed CCB & BB , 9(20%) patients were prescribed CCB & AB, 5(11%) patients were prescribed others, 3(7%) patients were prescribed CCB & ABB, 2(5%) patients were prescribed BB & ARB and 2(5%) patients were prescribed BB & ACEI

### 3.8. Distribution of the study population based on drug interactions

Out of 150 patients, the majority of patients 86(57%) had no type of drug-drug interactions, 52(34%) patients had antihypertensive drugs with other drug interactions, 9(6%) patients had both interactions and 4(3%) patients had antihypertensive drug interactions.

### 3.9. Distribution of the study population based on severity of drug interaction

Out of 150 patients, 64 patients were having drug interactions in their prescriptions. A total of 86 drug interactions were observed of which 50 were moderate 35 were major and 1 were minor.

**Table 1** Effect of mono therapy antihypertensive drugs on patient's hypertension

Blood pressure (mean $\pm$ sem)	On admission	On discharge	P-value	T-value
<b>Amlodipine</b>				
Sbp	132.8 $\pm$ 2.005	123.8 $\pm$ 1.593	0	7.5638
Dbp	87.6 $\pm$ 0.986	83.4 $\pm$ 0.988	0.0001	4.1303
<b>Cilnidipine</b>				
Sbp	131.7 $\pm$ 4.741	120 $\pm$ 4.082	0.0012	4.3112
Dbp	89.2 $\pm$ 2.289	83.3 $\pm$ 3.098	0.0463	2.2444
<b>Metoprolol</b>				
Sbp	131.7 $\pm$ 5.05	123.3 $\pm$ 3.333	0.0054	3.4578
Dbp	89.2 $\pm$ 1.93	86.7 $\pm$ 2.562	0.1911	1.3933
<b>Propranolol</b>				
Sbp	136.7 $\pm$ 8.819	123.3 $\pm$ 3.333	0.1835	2
Dbp	90 $\pm$ 5.774	86.7 $\pm$ 3.333	0.4226	1
<b>Atenolol</b>				
Sbp	130 $\pm$ 4.082	122.5 $\pm$ 2.5	0.2152	1.5667
Dbp	82.5 $\pm$ 2.5	80 $\pm$ 0	0.391	1
<b>Telmisartan</b>				
Sbp	138.3 $\pm$ 7.032	128.3 $\pm$ 4.773	0.0409	2.7386
Dbp	90 $\pm$ 2.582	85 $\pm$ 3.416	0.0756	2.2361

All the values are expressed as mean  $\pm$  SEM, \*p<0.05, \*\*p<0.01, and \*\*\*p<<0.00. [paired Student t-test] as compared to blood pressure on admission.

**Table 2** Effect of dual therapy antihypertensive drugs on patient's hypertension

Blood pressure (mean $\pm$ sem)	On admission	On discharge	P-value	T-value
<b>Amlodipine+metoprolol</b>				
Sbp	147.1 $\pm$ 5.654	124.3 $\pm$ 2.974	0.0068	4.0423
Dbp	92.9 $\pm$ 2.857	81.4 $\pm$ 2.608	0.0152	3.3607
<b>Amlodipine+atenolol</b>				
Sbp	155 $\pm$ 5	125 $\pm$ 5	0.0513	4.2426
Dbp	105 $\pm$ 5	85 $\pm$ 5	0.1056	2.8284
<b>Cilnidipine+metoprolol</b>				
Sbp	130 $\pm$ 10	120 $\pm$ 0	0.5	1
Dbp	85 $\pm$ 5	80 $\pm$ 0	0.5	1
<b>Amlodipine+prazosin</b>				
Sbp	142.9 $\pm$ 6.061	124.3 $\pm$ 2.02	0.0107	3.6527
Dbp	90 $\pm$ 4.88	81.4 $\pm$ 2.608	0.0167	3.2863
<b>Amlodipine+telmisartan</b>				
Sbp	142.9 $\pm$ 2.857	124.3 $\pm$ 2.02	0.0037	4.5962

Dbp	91.4 ± 2.608	82.9 ± 1.844	0.0167	3.2863
Metoprolol+telmisartan				
Sbp	115 ± 5	110 ± 0	0.5	1
Dbp	75 ± 5	75 ± 5	0	0
Metoprolol+enalapril				
Sbp	125 ± 25	115 ± 15	0.5	1
Dbp	85 ± 15	75 ± 5	0.5	1
Amlodipine+labetalol				
Sbp	166.7 ± 8.819	123.3 ± 3.333	0.0229	6.5
Dbp	103.3 ± 6.667	76.7 ± 3.333	0.0942	3.0237

All the values are expressed as mean± SEM, \*p<0.05, \*\*p<0.01 [paired Student t-test] as compared to blood pressure on admission.

**Table 3** Effect of multiple therapy antihypertensive drugs on patient's hypertension

Blood pressure (mean ± sem)	On admission	On discharge	P-value	T-value
Amlodipine +metoprolol+ labetalol				
SBP	180 ± 0	125 ± 5	0.0577	11
DBP	105 ± 5	80 ± 10	0.1257	5
Cilnidipine+metoprolol+prazosin				
SBP	165 ± 5	125 ± 5	0.0299	5.6569
DBP	90 ± 0	75 ± 5	0.2048	3
Amlodipine+metoprolol+telmisartan+labetalol				
SBP	175 ± 5	130 ± 0	0.0704	9
DBP	110 ± 0	85 ± 5	0.1257	5
All the values are expressed as mean± SEM, *p<0.05. [paired Student t-test] as compared to blood pressure on admission.				

**Table 4** comparison of efficacy between mono, dual, and multiple therapy of amlodipine

Drug	Blood pressure	Mean ± sem	P-value	T-value
Amlodipine (n=54)	Mean reduction in sbp	9 ± 1.19	0	7.5638
	Mean reduction in dbp	4.1 ± 1.004	0.0001	4.1303
Amlodipine+ telmisartan (n=12)	Mean reduction in sbp	18.6 ± 4.041	0.0037	4.5962
	Mean reduction in dbp	8.6 ± 2.608	0.0167	3.2863
Amlodipine+telmisartn + Metoprolol+labetalol (n=2)	Mean reduction in sbp	45 ± 5	0.0704	9
	Mean reduction in dbp	25 ± 5	0.1257	5

Reduction in SBP = SBP on admission – SBP on discharge; Reduction in DBP = DBP on admission – DBP on discharge

**Table 5** Comparison of efficacy between mono, dual, and multiple therapy of metoprolol

Drug	Blood pressure	Mean $\pm$ sem	P-value	T-value
Metoprolol (n=12)	Mean reduction in sbp	8.3 $\pm$ 2.41	0.0054	3.4578
	Mean reduction in dbp	2.5 $\pm$ 1.794	0.1911	1.3933
Metoprolol+amlodipine (n=7)	Mean reduction in sbp	22.9 $\pm$ 5.654	0.0068	4.0423
	Mean reduction in dbp	11.4 $\pm$ 3.401	0.0152	3.3607
Metoprolol+amlodipine +labetalol (n=2)	Mean reduction in sbp	55 $\pm$ 5	0.0577	11
	Mean reduction in dbp	25 $\pm$ 5	0.1257	5

Reduction in SBP = SBP on admission – SBP on discharge; Reduction in DBP = DBP on admission – DBP on discharge

**Table 6** identified ADRs reported

Class of antihypertensive	Drug name	Adverse even experienced	No of patients (n=8)	
CCB	Amlodipine	Hyperpigmented nodules	1	4(50%)
		Swelling of lls, from ankle extended to knee	1	
		Sob	1	
		Headache	1	
BB	Metoprolol	Decreased heart rate	1(12.5%)	
ARB	Telmisartan	Blurred vision	1(12.5%)	
ACEI	Enalapril	Hypotension	1(12.5%)	
AB	Prazosin	Rash	1(12.5%)	

#### 4. Discussion

The study of drug use may shed light on various facets of drug use and prescription, including patterns, quality, determinants, and outcomes of drug use. Among the participants in the study, men were more affected (57%) than women in terms of gender. Elevated levels of androgen, such as testosterone, are thought to be the reason for the larger proportion of male patients since they contribute to blood pressure elevation.<sup>8, 11, 18</sup>

The prevalence of hypertension was 2% in the 18–29 age group and 29% in the 60–69 age group. Most of the patients belonged to the 50–70 age range. This population may have a higher prevalence of hypertension as a result of lifestyle modifications, comorbid illnesses, complications from hypertension, or poor treatment compliance.<sup>1, 2, 11</sup>

Hypertension was staged following JNC VIII recommendations. Of the 150 patients, the majority of the patients 66 (44%) had prehypertension, 46 (31%) had stage I hypertension, and the lowest members 13 (8%) had stage II hypertension.<sup>2, 7, 8, 12</sup>

Risk factors for a higher prevalence of hypertension include aging, drinking, smoking, chewing tobacco, no physical activity, and heredity. Among the 150 participants, 127 patients had hypertension as a result of their advanced age. 88 had hypertension as a result of no physical activity. 53 people had hypertension as a result of drinking as a risk factor. 36 patients were smokers. Six individuals had genetically caused hypertension.<sup>2, 7</sup>

Out of 150 patients, 86 (87.33%) patients were with complications which included both single 70 (81.39) and multiple 16 (18.61%) complications. Among single complications, the majority of the patients 47 (67.14%) were affected with CKD, 10 (14.29%) patients were affected with stroke, and the lowest 1 (1.43%) was affected with HRS.<sup>9</sup> Among

multiple complications, the majority of patients 7(43.75%) were affected with CKD and HF, and the lowest patients 2(12.5%) were affected with stroke and CKD

Among the 150 patients, 92(62%) received monotherapy, 44(29%) received dual therapy and 14(9%) received multiple therapy.<sup>13,14,15</sup> The current study found that single-drug therapy was used more frequently than multiple-drug therapy. This can be because of the patient's compliance, favorable response, and minimal frequency of side effects.<sup>11,12,17</sup> A study by Kale A. et al. <sup>[11]</sup> Rachana Pret al. <sup>[12]</sup>, and Joseph et al. <sup>[17]</sup> found that CCBs were the most often utilized class of drugs, which is consistent with the results of our analysis. CCBs and ARBs 12 (27%) are the dual antihypertensive drugs that are prescribed the most, followed by CCBs and BBs 11 (26%).<sup>12</sup> In our analysis, the use of amlodipine, the CCB, as an antihypertensive agent outpaces that of any other antihypertensive medication. The lengthy duration of action and once-daily dosage, which enhance patient compliance and allow for sustained and regulated blood pressure management, are the qualities that make it an excellent antihypertensive medication. Similar patterns have also been observed in research conducted by Rachana et al. and Xavier et al. <sup>[12,13]</sup> While studying the efficacy of mono and dual therapy in our study it was observed that monotherapy showed more significance than dual therapy. This was opposed by Shalavad HM et al. <sup>[1]</sup>

Out of 150 patients, 64 (53%) patients had drug-drug interaction and the remaining 86(57%) patients had no drug-drug interaction. Among 64 (53%) patients, the majority of the patients 52(34%) had antihypertensive drugs with other drug interactions, 9(6%) patients had both interactions and 4(3%) patients had antihypertensive drug-drug interactions, These outcomes were comparable to those of Shalavad HM et al. <sup>[1]</sup>, Out of 150 patients, 64 patients were having drug interactions in their prescriptions. A total of 86 drug interactions were observed of which 24 were major 13 were minor and 6 were moderate.

Out of 150 patients, 8 ADRs were recorded. Four (50%) of the eight adverse drug reactions were caused by amlodipine. The other four ADRs were 12.5% Metoprolol, 12.5% Telmisartan, 12.5% enalapril, and 12.5% prazosin these results were supported by Baig MA et al. <sup>[8]</sup>, Shalavad HM et al. <sup>[1]</sup>

According to recommendations made by the JNC VIII guidelines, first-line drugs for the management of hypertension can be any one of the four drug classes CCBs, ARBs, ACEIs, and diuretics. The fact that CCBs are prescribed more frequently than other antihypertensive medications indicates that the prescribing pattern complies with the guidelines. Compared to other medications, amlodipine use was high in our study.

#### 4.1. Complication

Hypertension is a progressive and complex disorder that is difficult to treat effectively in the long term. Evaluate the antihypertensive medication use pattern in the general medicine department utilizing the current study. This study has shed light on the prescribing practices for antihypertensive drugs concerning the degree of blood pressure management. In this study, post-analysis of 150 case sheets, denoted that the physicians preferred single drug therapy more than multiple drug therapy and the most frequently prescribed class was the CCBs class of antihypertensive agents. Among CCBs, amlodipine was the most frequently utilized antihypertensive drug. The knowledge and prescription of the drug were concluded to be the baseline idea of ADRs and drug interaction of antihypertensive drugs in hypertensive patients. The ADRs were identified and reported to the pharmacovigilance center. Patients too need to show their desire in knowing more about the drugs they have been prescribed, and proper counseling regarding antihypertensive drug interactions can promote safe knowledge of their condition and particular treatment, which would improve their quality of life. According to our study examination of antihypertensive drug use, the JNC VIII Guidelines were compared for the treatment of hypertension. Most of the patients' drug prescriptions do not follow JNC-VIII guidelines, other than empirical therapy was followed for the treatment of hypertension due to various comorbidities and complications of the patients.

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#### 5. Conclusion

The Eighth Report of the JNC on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 8) guidelines for the treatment of hypertension were fully complied with by the prescribing pattern, according to our study's analysis of antihypertensive medication usage. CCBs were the preferred medication for hypertensive patients, and monotherapy was consistently more advised in the early stages of hypertension to reach the target blood pressure goal. The baseline understanding of adverse drug reactions (ADRs) of antihypertensive medications in hypertension patients who visited the outpatient department of a tertiary teaching care hospital in India was determined by the knowledge and prescription of the medication. We can conclude from this study that all of the prescriptions were reasonable; nonetheless, further adjustments must be made to the way antihypertensive medications are prescribed

for people with hypertension. In order to improve quality of life, patients must give knowledge and appropriate counselling about medication adverse drug reactions.

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### Compliance with ethical standards

#### *Disclosure of conflict of interest*

No conflict of interest to be disclosed.

#### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

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