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A Prospective Drug Utilization Study in Geriatric Hypertensive Patients in a Tertiary Care Hospital, Mumbai

Gauri Billa[1*], Shirish Joshi[1], Santosh Salagre[2] and Karan Thakkar[3]

[1]Department of Pharmacology, Seth GS Medical College and KEM Hospital, Mumbai, India.
[2]Department of Cardiology, Seth GS Medical College and KEM Hospital, Mumbai, India.
[3]Department of Pharmacology, Grant Medical College and Sir J J Group of Hospitals, Mumbai, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author GB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors SJ, SS and KT contributed to the protocol and managed the analyses of the study. Authors GB and KT managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: The geriatric population assumes great significance in terms of both preventive and curative health care services utilized. The patho-physio-psychological changes associated with ageing make their problems unique. In the geriatric population, hypertension accounts for a huge proportion of cardiovascular and all cause mortality and morbidity. We conducted a study to describe the patterns of antihypertensive drug use in the geriatric population, compare it to the current recommendations and conduct an analysis using the WHO-INRUD drug use indicators.
Methods: A prospective cross sectional drug utilization study of 100 prescriptions of hypertensive patients (as per JNC 7) of either sex and ≥60 years was undertaken as per the WHO – DUS and the STROBE guidelines.
Results: Statistically significant relation was found between BP control, and addictions and CIRS-G score. The 100 prescriptions contained 344 drugs, out of which, 171 were antihypertensive drugs. Three percent of antihypertensive drugs were prescribed by generic names. Seventy nine

**Corresponding author: Email: gauribilla@gmail.com;*

percent of antihypertensive drugs were prescribed from the 'hospital drug schedule'. Amlodipine, Hydrochlorothiazide, Losartan and Telmisartan were prescribed to 79%, 24%, 11%, 11% respectively. The combination of ARB (Angiotensin Receptor Blocker) + Diuretic was prescribed to 36% and that of ARB + CCB (Calcium Channel Blocker) was prescribed to 21%. The PDD/DDD ratios of Carvedilol, Losartan, Furosemide and Telmisartan were 0.7, 0.8,1 and1.2, respectively.
Conclusion: Creating awareness regarding the role of addiction in BP control and advocating lifestyle changes is paramount in HTN management. Overall, the principles of rational prescribing were followed. The prescription pattern observed was as per current recommendations.

Keywords: JNC; prescribing pattern analysis; cardiovascular drugs; anatomical therapeutic and chemical classification; daily defined dose; prescribed daily dose; cumulative illness rating scale for geriatrics; addictions; rational drug use.

1. INTRODUCTION

In India, the elderly population is expected to increase by 3.5 times from 57 million in 1991, to 198 million in 2030 and by 6 times to 326 million in 2050 [1]. Projections made by the United Nations indicate that 21% of the Indian population will be above 60 years by 2050 as against 6.8% in 1991 [2]. The elderly population will assume greater importance by their sheer numbers and utilization of both preventive and curative health care services. This was echoed by the World Health Organization (WHO) theme for the 'World Health Day -2012', 'Ageing and Health' [3].

Hypertension is one of the most important treatable causes of cardiovascular and all cause mortality and morbidity in the geriatric population [4–7]. In 2010, arterial hypertension was the leading risk factor responsible for the global burden of diseases [7]. In the USA, in 2011, the leading cause of death in the elderly were heart diseases and a large proportion of them were due to high blood pressure [7,8]. Pharmacotherapy in geriatric hypertensive patients has been recommended with a greater degree of caution due to the patho-physiological alterations associated with ageing [9]. In addition, compliance to therapy also becomes an important factor in the geriatric population.

Drug utilization [DU] studies can identify the most frequent prescribing errors and their causes, providing numbers that can be analyzed. DU studies are a potential tool in the evaluation of health systems [10]. Such DU studies describing the pattern of anti hypertensive drug use in the geriatric population in India are scarce. Keeping this in mind, we conducted a study with the following objectives:

- To describe and analyze the observed patterns of antihypertensive drug use in the geriatric population.
- Compare the observed pattern to the current recommendations.
- Conduct a drug utilization analysis as per the DUS metrics and drug use indicators.

2. METHODOLOGY

After the Institutional Ethics Committee approval, a prospective cross sectional drug utilization study of 100 prescriptions of hypertensive patients (as per JNC 7) of either sex and ≥ 60 years was undertaken as per the WHO – DUS [11] and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [12].

The study site was the Hypertension clinic of King Edward Memorial Hospital, Mumbai, during the period from August 2011 to January 2012. Patients who had been on antihypertensive drug[s] for at least one month were included. Patients having any emergency/life threatening medical/surgical conditions were excluded. A written informed consent was obtained from the participants before their recruitment and all the data collected was kept strictly confidential. Patient characteristics, diagnosis, and data about the prescription pattern were collected and recorded in a structured case record form.

The prescription pattern was analyzed as per the WHO-INRUD [International Network for Rational Use of Drugs] drug use indicators. The prescribed drugs were classified as per the ATC-DDD [Anatomical Therapeutic Chemical - Defined Daily Dose] classification. The PDD [Prescribed daily dose] values, i.e., the average daily prescribed dose and the PDD/DDD ratio were calculated [13].

Descriptive statistics were used to determine the extent and patterns of antihypertensive drug use and the results were expressed as percentage and mean ± standard deviation using the software Microsoft Excel ® 2007. The level of significance was fixed at 5% [p<0.05] with 95% confidence interval. The Chi–Square test was used and all statistical calculations were carried out with Open Epi: A Web-based Epidemiologic and Statistical Calculator [14].

3. RESULTS

3.1 PROFILE OF STUDY PARTICIPANTS

The age range of participants was 60 – 84 years with a mean of 67.6 years and a standard deviation of ±6.4 years. The BP control status of our participants was analyzed with respect to their various characteristics as shown in Table 1. The number of patient's falling in the different categories as per their current measured BP values and JNC 7 is depicted in the Table 2.

3.2 Prescription Pattern

The WHO-INRUD Drug Use Indicators are shown in Table 3. Out of 344 drugs prescribed to 100 participants, 171 were anti hypertensives and the others were multi-vitamin tablets and drugs for comorbid disorders like diabetes mellitus, coronary artery disease, joint pain, osteoporosis, dyspepsia and so on. The most commonly co-prescribed drug was tablet calcium lactate. All the prescriptions were complete in the terms of describing the dosage form, dose, route of administration, frequency and duration of treatment. Out of all the FDCs prescribed, 18 were antihypertensive FDCs.

3.3 Antihypertensive Drugs Prescribed

The various antihypertensive drugs prescribed to the participants are depicted in Table 4. The various two and three antihypertensive drug combinations prescribed to participants are depicted in Fig. No. 1 and 2. Eighteen antihypertensive FDCs were prescribed to the participants.

3.4 ATC-DDD Classification

Anatomical Therapeutic Chemical (ATC) – Daily Defined Dose (DDD) classification of the various antihypertensive drugs prescribed, along with the calculated Prescribed Daily Dose (PDD) values and the PDD/DDD ratios are mentioned in Table 5.

Table 1. Characteristics of geriatric hypertensive patients (n=100] visiting the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

Sr. no	Characteristics		No. of participants with their BP values		Total	p value	CMLE odds ratio	CL [UL,LL]
			WNL n (%]	BNL n [%]				
1.	Age (years]	60-69	44 (73.3)	16(26.7]	60	0.7	-	-
		70-79	19 (65.5)	10 (34.5]	29			
		≥80	7 (63.6)	4 (36.4]	11			
2.	Gender	Female	38 (65.5)	20 (34.5]	58	0.13*	0.6	0.2, 1.5
		Male	32 (76.2)	10(23.8]	42			
3.	Marital status	Married	34 (64.2)	19 (35.8]	53	0.1	-	-
		Unmarried	1 (33.3)	2 (66.7)	3			
		Widow/ widower	35 (79.5)	9 (20.5)	44			
4.	Addictions	No addictions	56 (80)	14 (20)	70	<0.001*	4.5	1.8,11.7
		Addictions	14 (46.7)	16 (53.3)	30			
5.	CIRS-G score † (Min-0, Max-56)	≤ 28	48 (64)	27 (36)	75	0.01*	0.25	0.1, 0.8
		> 28	22 (88)	3 (12)	25			
6.	Type of drug therapy	Single	35 (68.6)	16 (31.4)	51	0.8*	0.87	0.4, 2.1
		Combination (≥2)	35 (71.4)	14 (28.6)	49			
7.	Socio-economic class	Middle class	15 (65.2)	8 (34.8)	23	0.33	0.8	0.3, 2.3
		Lower class	54(70.1)	23 (29.9)	77			

** Mid-p exact; † Cumulative Illness Rating Scale for Geriatrics; CMLE – Conditional maximum likelihood ratio; CL-Confidence limits; UL-upper limit; LL- lower limit,WNL- Within normal limits & BNL – Beyond Normal Limit (as per JNC 7)*

Table 2. Number of geriatric hypertensive patients belonging to various blood pressure categories as per JNC 7, Mumbai 2011-12

Category as per JNC 7	Blood pressure values * (Systolic/diastolic mm of Hg)	No. of patients (n/100)
Normal	< 120 / < 80	22
Pre-hypertension	120-139 / 80-89	48
Stage 1 hypertension	140-159 / 90-99	12
Stage 2 hypertension	160 / 100	10
Isolated systolic hypertension	> 140 / < 90	8

** BP measured during the current visit*

4. DISCUSSION

Majority of our participants were in the age range of 60-69 years. Those >80 years were the least. A study conducted by Tiwari et al. showed a similar age distribution [15]. This can be explained by the fact that hospital consultations become relatively less common with increasing patient age as the elderly probably have more chronic pathology and are less mobile than the younger population [16].

On analysis, a statistically significant ($p<0.05$) relation was found between BP control on one hand and addictions and co-morbidity score on the other. A significant number of our participants (30%) had addictions in the form of smoking, alcohol, tobacco chewing and '*misri*' application (roasted tobacco applied as tooth powder). We found that individuals with addictions may be 4.5 times more likely to have their BP values beyond the normal values (as per JNC 7), despite being on treatment. The results of a study conducted by Shankarishan P et al indicated that incident hypertension cases are largely attributable to the habit of tobacco use, alcohol consumption and smoking [17].

Besides pharmacotherapy, modification of these lifestyle factors needs to be emphasized as a major strategy for reducing incidence of hypertension via education and awareness. Another very important lifestyle modification for managing high BP is moderate intensity physical activity in the elderly population which will also help to improve the over all quality of life [18]. Besides these modifiable risk factors for high BP, there exist very important non-modifiable risk factors - genetic polymorphisms. For example, the expression of the 'calcium/calmodulin-dependent kinase IV' (CaMKIV) regulates blood pressure by controlling the endothelial nitric oxide synthase activity and the role of G-protein-coupled receptor kinase 2 and 5 in regulating the vascular tone by modulatinf the beta-adrenergic pathway [19–21].

Table 3. Assessment of the prescription pattern as per various drug use indicators in geriatric hypertensive patients (n=100) visiting the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

S. no.	Drug use indicators	Result
1.	Average number of drugs per prescription [Mean±SD]	3.44±1.41
2.	Average number of antihypertensive drugs per prescription [Mean±SD]	1.71±0.62
3.	Percentage of prescriptions containing FDCs	32% [32 of 100]
4.	Percentage of antihypertensive drugs prescribed as FDCs	10.52% [18 of 171]
5.	Percentage of antihypertensive drugs prescribed by generic name	2.92% [5 of 171]
6.	Percentage of antihypertensive drugs prescribed by brand name	97.08% [166 of 171]
7.	Percentage of antihypertensive drugs prescribed from the hospital drug schedule	79.53% [136 of 171]
8.	Percentage utilization of drugs from the WHO EML*-2011 and NLEM† [India]-2011	100%

** WHO EML: World Health Organization Essential Medicines List, † NLEM: National List of Essential Medicines [India]*

To analyze the level of co-morbidity, we calculated the CIRS-G score (Cumulative Illness Rating Scale for Geriatrics) [22]. We found that more number of individuals with a higher CIRS-G score had their BP values within normal limits compared to those with lower scores. The presence of co-morbidities like diabetes,

dyslipidemia, previous history of coronary or cerebrovascular disease in a patient with hypertension increases the risk of adverse health outcomes manifold. Out of these, diabetes plays a big role independent of the others. It not only accelerates the progression and complications, but also alters response to therapy [23,24]. Hence, this population needs to be managed aggressively and their BP values should be maintained strictly within normal limits as was done in our study.

Majority of the participants were from the lower socioeconomic class (77%) as is expected in 'public hospitals' like ours [25].

4.1 Diagnosis and BP Values

According to the JNC 7, the treatment goal for individuals with hypertension is <140/90 mm of Hg [9]. Accordingly, a good number (70%) of the geriatric patients were controlled on their current drug regimen. A study conducted by Mendelson et al in geriatric population >80 years showed similar results [26]. As per the recently published JNC – 8, the threshold for starting antihypertensive drugs has been increased from ≥140/90 to ≥150/90 for individuals above 60 years and not suffering from co-morbid disorders like diabetes and/or chronic kidney disease. For others, i.e., individuals <60 yrs and those ≥18yrs suffering from diabetes or CKD, the threshold remains ≥ 140/90 [27]. If we had applied the JNC - 8 criteria in our study, our results would have remained the same, except one individual with a BP of 144/80 (classified as isolated systolic HTN), who would have been classified as having WNL BP values. Also, a point to note is that unlike JNC -7, JNC -8 doesn't specify categories as per BP values like pre-HTN, stage 1, 2 and isolated systolic HTN.

4.2 WHO-INRUD Drug Use Indicators

All the prescriptions were complete in the terms of describing the dose, route of administration, frequency and duration of treatment. A study conducted in Mexico by Corona-Rojo et al in patients >70 years had a high number (53%) of potential prescription errors [28]. Most of the prescription errors were due to the lack of information about dosage [6%], administration route (13%), frequency and timing of dose (1%), and the duration of treatment (42%). Such errors can lead to adverse treatment outcomes in the elderly patients and thus the prescribers should follow the rational prescribing norms as seen in our study. The most common definition of polypharmacy is the use of five or more drugs at the same time in the same patient [29]. In our study, the average number of drugs per prescription was 3.44. In studies conducted in Gujarat and Hyderabad, in patients >65 years, polypharmacy was found and the average number of drugs per prescription was 7.3 and 6.07, respectively [30,31]. The average number of anti-hypertensives per prescription was 1.71 ± 0.52 in our study, which was slightly higher than that in a study from China (1.45 ± 0.66) [32]. The concurrent use of several drugs not only increases the chance of drug interactions in geriatric population but may also lead to confusion, poor compliance and adverse drug reactions [29]. The JNC 7 guidelines also recommend monotherapy as first line for majority of the hypertensive patients [9].

Table 4. Various antihypertensive drugs prescribed to geriatric hypertensive patients (n=100) attending the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

Sr. no.	Class of drug	Name of the drug	Number of participants prescribed the drug (n/100)	Total drugs of a class " t "	% use of the drug class [(t/171)x100]
1	Diuretics	Hydrochlorothiazide	25	31	18.1
		Furosemide	6		
2	ACE Inhibitors	Ramipril	8	11	6.4
		Enalapril	1		
		Lisinopril	2		
3	ARBs	Losartan	11	29	16.9
		Telmisartan	11		

Sr. no.	Class of drug	Name of the drug	Number of participants prescribed the drug (n/100)	Total drugs of a class " t "	% use of the drug class [(t/171)x100]
		Olmesartan	6		
		Valsartan	1		
4	β blockers	Atenolol	10	19	11.1
		Metoprolol	8		
		Carvedilol	1		
5	α blocker	Prazosin	1	1	0.7
6	CCB	Nifedipine	1	80	46.8
		Amlodipine	79		

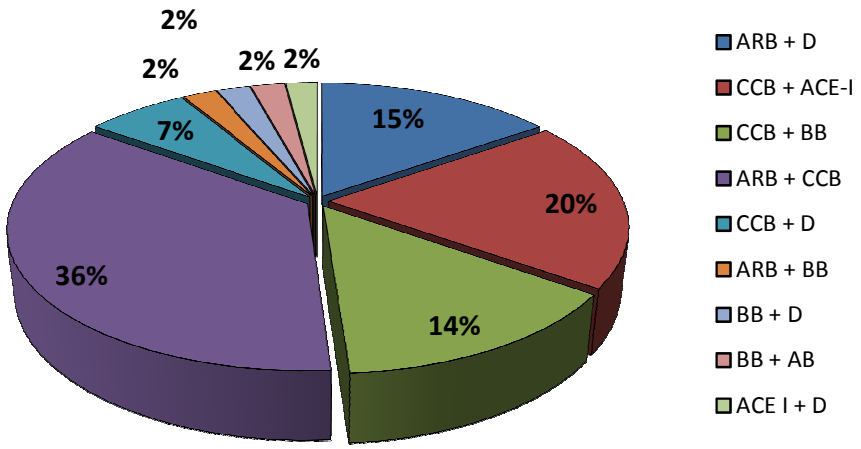

Fig. 1. Proportion of various 'two antihypertensive drug' combinations (n=27) [either as 1+1 drugs (9/27) or FDCs (18/27)] prescribed to geriatric hypertensive patients (n=100) attending the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

CCB - Calcium Channel Blocker; ACE I - Angiotensin Converting Enzyme Inhibitor; ARB - Angiotensin Receptor Blocker; BB - β Blocker; D – Diuretic; AB - α Blocker

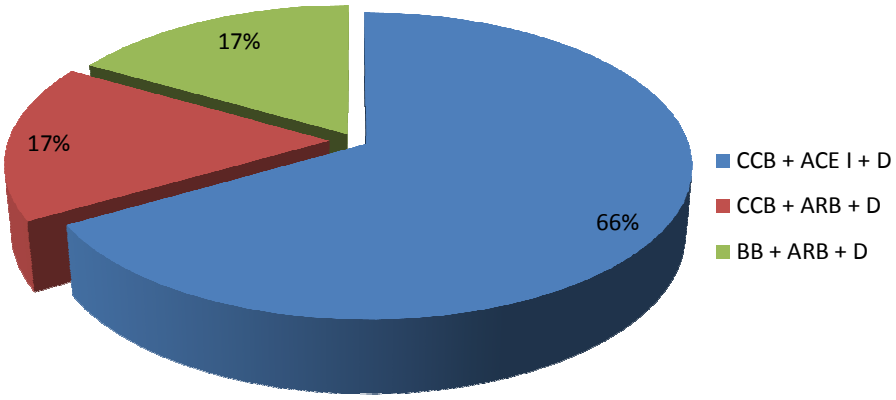

Fig. 2. Proportion of various 'three antihypertensive drug' combinations (n=22) prescribed to geriatric hypertensive patients (n=100) attending the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

CCB - Calcium Channel Blocker; ACE I - Angiotensin Converting Enzyme Inhibitor; ARB - Angiotensin Receptor Blocker; BB - β Blocker; D – Diuretic

Table 5. ATC-DDD classification and the calculated PDD and PDD/DDD ratio of antihypertensive drugs prescribed to geriatric hypertensive patients [n=100] attending the hypertension OPD of a tertiary care hospital, Mumbai 2011-12

Sr. no.	Drug	ATC code	DDD [mg]	PDD [mg]	PDD/DDD
1	Enalapril	C09AA02	10	2.5	0.3
2	Metoprolol	C07AB02	150	46.4	0.3
3	Lisinopril	C09AA03	10	5	0.5
4	Valsartan	C09CA03	80	40	0.5
5	Hydrochlorothiazide	C03AA03	25	13.8	0.6
6	Atenolol	C07AB03	75	42.5	0.6
7	Carvedilol	C07AG02	37.5	25	0.7
8	Losartan	C09CA01	50	40	0.8
9	Nifedipine	C08CA05	30	30	1
10	Furosemide	C03CA01	40	40	1
11	Telmisartan	C09CA07	40	48.3	1.2
12	Ramipril	C09AA05	2.5	3.6	1.4
13	Olmesartan	C09CA08	20	30	1.5
14	Amlodipine	C08CA01	5	7.6	1.5
15	Prazosin	C02CA01	5	10	2

Approximately, 3% of the anti-hypertensive drugs were prescribed by their generic names. Similar results were obtained in a study conducted by Aqil M [33]. Other studies from India have reported prescribing by generic name to the extent of 15.6% [30], 38.85% [34] and 46.2% [35] which is higher than that in our study but still lower than the WHO recommendation of 100%. Although, the WHO-INRUD and popular literature say that one should prescribe by generic names, there is a difference between prescribing cheap generic drugs and simply prescribing by generic names [36].

The reasons in favour of brand prescribing as stated by other studies are reputation of the pharmaceutical company, availability and ease of remembering the brand name, cost of drugs and impact of medical representatives of pharmaceutical companies [30,33–35,37]. In our study, the ease of remembering and using shorter brand names seemed to be the probable factors. For example, using Amlo instead of Amlodipine and using Aten instead of Atenolol.

Most of the antihypertensive drugs (78%) were prescribed from the hospital drug schedule. Whenever brand names were used, the hospital pharmacist would have to search the drug index to match the prescribed brand name with the available generic drugs in the hospital formulary and dispense the same. This practice is called generic substitution. Generic substitution could be a major cause of medical errors [38,39]. It can also lead to increased confusion and time consumption for the hospital pharmacist. Generic substitution could also add to the confusion in the elderly, especially in a population like ours with low education levels, who rely on the packaging, shape and colour of the tablets as cues for identification of their medications. All this can be largely avoided if the prescribers strictly adhere to prescribing by generic names when prescribing form the hospital pharmacy. When prescribing from the outside chemists, it is better to prescribe brand names of generic drugs with good quality and low cost [36].

The use of FDCs in our institution was only 10.5%. Partly, this may be because our hospital pharmacy does not stock many FDCs. FDCs don't permit adjustment of the dose of individual drugs as per the clinical response, thereby, they may increase the risk of drug interactions and ADRs. Besides, they may also increase the overall cost of prescription. On the contrary, the use of FDCs can improve compliance, especially in geriatric population, by decreasing the total pill burden. Based on the benefit/risk ratio and other factors like awareness and compliance profile, the prescription of FDCs must be individualised.

4.3 Antihypertensive Drugs Prescribed

Overall, Amlodipine was the most commonly prescribed antihypertensive followed by ARBs and hydrochlorothiazide. The other less commonly prescribed drugs were β blockers, ACE inhibitors, Furosemide and the 'α blocker' - Prazosin. Our results are similar to other studies conducted in India and abroad [32,40]. This is in contrast to the results of a study conducted by Mendelson G et al, where the most commonly prescribed drugs were diuretics, while calcium channel blockers were prescribed to only 16%. The mean age of the participants in that study

was 80 ± 8 years (range 59 to 101 years) [26]. Our results were also significantly different from a study conducted by Maluf Jr I et al. where captopril was the most commonly used drug whereas amlodipine was not used at al. [41].

Such differences in the prescribing patterns can be attributed to the lack of a consensus guideline and limited evidence in the form of large scale and long term trials conducted specifically in geriatric hypertensive patients [42].

The large scale use of CCBs in our study can be explained by their pharmacological properties. The CCBs are well suited for elderly hypertensive patients who show increasing arterial stiffness and diastolic dysfunction secondary to decrease atrial and ventricular compliance. The CCBs also have multiple clinical applications including the treatment of angina and supra ventricular arrhythmias (verapamil and diltiazem). They are well tolerated by the elderly with deranged metabolic profiles. In a change from its previous version, the NICE 2011 guidelines [43] also recommend initial treatment with a CCB for all patients >55 years. This is in contrast to JNC 7 guidelines which recommend the use of a diuretic as first line [9]. As per the new JNC 8, any of the four groups – CCBs, Diuretics, ARBs or ACE inhibitors can be used as first line. The JNC 8 says that CCBs should in fact be preferred over ARBs/ACE-I in the non-white population [27]. The American College of Cardiology Foundation/American Heart Association (ACCF/AHA 2011) [44] stresses that initial therapy should, if possible be a diuretic and if another class were prescribed as first-line, the second drug should always be a diuretic. One of the reasons for underutilization of diuretics seen in our study could be that the diuretics like thiazides reduce glucose tolerance in diabetics, cause dyslipidemia and hypokalemia [45]. But, only 16% geriatric patients in our study were diabetic.

The most commonly prescribed 'two drug' therapy was a CCB [amlodipine] + ARB [36%], followed by CCB [amlodipine] + ACE-I [20%]. A clear superiority has been shown in the ACCOMPLISH trial [46] for the combination of ACE inhibitor + CCB compared to ACE inhibitor + diuretic [relative risk reduction of 21% for cardiovascular events]. This effect was independent of age [either older or younger than 80 years].The NICE guidelines recommend the addition of ACE inhibitors or ARBs to a CCB if a CCB alone is ineffective [43]. The observed prescription pattern is in accordance with the above recommendations.

ARBs alone or in combination with hydrochlorothiazide are preferred in geriatric hypertensives as co-morbid conditions tend to affect this population. ARBs are alternatives to ACE inhibitors in patients with hypertension and heart failure or albuminuria due to diabetic nephropathy, who cannot tolerate ACE inhibitors [9,44]. The prescription rate for ARBs has risen considerably over time [47] and the same was evident in our study too. The explanation for this is better tolerance and lack of side effects. A study conducted by Cong Ma, et al in 2012 has demonstrated the advantage of ACE inhibitors over ARBs [48], but this requires more conclusive evidence.

4.4 ATC/DDD Classification and DUS Metrics [13]

The ATC/DDD classification will allow easy comparison between our study and other such studies at different locations. When the PDD/DDD ratio is 1, it means that the prescribed and defined daily doses are the same. When the PDD/DDD ratio is either less than or greater than 1, it may indicate that there is either under or over utilization of drugs, respectively. However, it is important to note that the PDD can vary according to the severity of illness. The PDDs can also vary substantially between different countries, for example, PDDs are often lower in Asian than in Caucasian populations. Also, the DDDs obtained from the WHO ATC/DDD website are based on international data. The WHO encourages countries to have their own DDD list based on indigenous data. The PDD/DDD ratio in our study for various drugs varies from 0.3 [Enalapril] to 2 [Prazosin]. The exploration of reasons for the PDD being different from the DDD in geriatric population would be an interesting subject of further research.

5. SUMMARY AND RECOMMENDATION

- Participants with addictions were 4.5 times more likely to have out of control BP values.
- More number of participants with a higher CIRS-G score had their BP values within normal limits, probably due to more aggressive treatment.
- No statistically significant relation was found between the BP control and age, gender, marital status, socio-economic

class or the number of drugs prescribed to the participants.

- Majority of our participants (70%) had their BP values under control on treatment.
- Overall, the principles of rational prescribing were followed in geriatric hypertensive patients as per the WHO/INRUD drug use indicators.
- When prescribing from the hospital pharmacy, generic names should be used to avoid generic substitution. When prescribing from the outside chemists, it is better to prescribe brand names of generic drugs with good quality and low cost.
- The most commonly prescribed anti hypertensive drug was the CCB – Amlodipine. This is in accordance with the latest recommendations.
- The least commonly prescribed anti hypertensive drug was the alpha blocker Prazosin because it causes postural hypotension and is best used as a reserved drug for hypertension.
- ARBs were prescribed much more than the ACE-Is.
- The most commonly prescribed two drug combination was a CCB (amlodipine) with an ARB as per the current recommendations.
- There is a need to develop Indian DDDs in order to better interpret the PDD/DDD ratio and comment on under or over-utilization.

ETHICAL APPROVAL

All authors hereby declare that the study protocol was examined and approved by the Institutional ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.
The authors also declare no conflict of interest.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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