



## RESEARCH ARTICLE

### PHARMACOEPIDEMIOLOGY OF ANTIHYPERTENSIVE DRUGS IN A TERTIARY CARE HOSPITAL, MADHYA PRADESH, INDIA

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#### ABSTRACT

**Aims and Objectives:** The aim of study is to determine the frequency and prescribing pattern of antihypertensive drugs in Out Patient Department of a tertiary care hospital and to identify whether the pattern of prescribing is appropriate in accordance with national and international guidelines for pharmacotherapy of hypertension.

**Methods:** This is a prescription-based survey; the prescriptions were collected randomly from OPDs of SGM Hospital in form of Xerox copy after taking the consent, the total 3587 prescriptions were analyzed.

**Results:** In the 3587 prescriptions total 8144 drugs were prescribed; of these only 4.19% (342) drugs were belonging to cardiovascular groups. Amongst the cardiovascular drugs 94.73% (324) were belongs to antihypertensive and 5.26% were to anti-CHF (drugs) groups. 91.35% drugs were prescribed as monotherapy and 8.64% as combination therapy. The CCBs (Amlodipine 83.47%) were the most frequently prescribed (35.49%) antihypertensive followed by ACEIs 25% (Enalapril 60.49%), β-blockers 13.27% (Atenolol 69.76%), AT1 antagonist or ARBs 9.25% (Losartan 80.0%), combination therapy 8.64% (AT+AM = LO+HCTZ 46.42%) and diuretics 8.33% (Hydrochlorothiazide 55.55% 27). However over all prescribing frequency amongst antihypertensive drugs were as follow; Amlodipine (29.63%) ≥ Enalapril (15.12%) ≥ Ramipril (9.87%) ≥ Atenolol ≥ (9.25%) ≥ Losartan (7.40%) hydrochlorothiazide ≥ (4.63%) ≥ Es-amlodipine (4.32%) ≥ AT+AM (4.01%)= LO+HCTZ (4.01%) ≥ Frusemide (3.70%) ≥ Candesartan (1.85%) ≥ Metoprolol (1.54%) and others.

**Conclusions:** Most of antihypertensive in this study were prescribed as monotherapy. CCBs; Amlodipine was most frequently prescribed antihypertensive followed by Enalapril ≥ Ramipril ≥ Atenolol ≥ and Losartan, in combination therapy AT+AM and LO+HCTZ were equally prescribed. The pattern of this study were appears to be in accordance with the national and international guidelines.

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#### INTRODUCTION

Hypertension (HTN) is one of the major chronic diseases resulting in high morbidity and mortality in the world population.

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Hypertension is a disease of complex etiology (Kearney et al., 2005). It occurs nearly in 75% of adults with cardiovascular disease (Ker, 2010). Prevalence of HTN in India is reported to vary from 4-15% in urban and 2-8% in rural population. It is estimated that the worldwide prevalence of hypertension would increase from 26.4% in 2000 to 29.2% in 2025. (Kearney, 2005) Hypertension is estimated to affect 972 million adults worldwide, with 66% of those affected are

from low and middle income countries, including India. In India currently about one and half billion people will suffer from hypertension (Kearney, 2005). The overall burden of hypertension related disease is rapidly rising in the developing world as a consequence of the aging population and increasing urbanization (Yusuf, 2001). Hypertension is defined as a systolic blood pressure (SBP) higher than 140 mmHg and a diastolic blood pressure (DBP) higher than 90 mmHg. The diagnosis is based on the average of 2 or more readings taken at each of 2 or more visits after an initial screening ([www.nhlbi.nih.gov/guidelines/hypertension](http://www.nhlbi.nih.gov/guidelines/hypertension)) (Carter, 1998). However according to JNC-8 guideline elevated BP was defined as systolic BP >139 mmHg and diastolic BP (DBP) >89 mmHg (James *et al.*, 2014). Hypertension is an established risk factor for cardiovascular diseases (such as myocardial infarction, arrhythmias, angina pectoris, cardiac failure) and for renal complications with shortened expectancy of life. Despite the availability of a wide range of antihypertensive drugs, hypertension and its complications are still an important cause of adult morbidity and mortality (Isezuo *et al.*, 2000 Cappuccio *et al.*, 2004). The aim of our study is to evaluate and analyze the prescribe pattern of antihypertensive therapy and to observe the prescribing attitude of physicians as the treatment guideline should be change time to time with the aim of rational use of drug.

## MATERIAL AND METHODS

This observational study “*Pharmacoepidemiology of antihypertensive drugs in a tertiary care Hospital, Madhya Pradesh, India*” was carried out in the department of pharmacology, S.S.M.C and associated S.G.M.H Rewa (MP) from September 2013 to June 2014. For this study prescriptions were collected randomly from the patients visiting OPDs departments and taking medications from S.G.M. hospital pharmacy, OPD pharmacy and Red Cross pharmacy situated in the S.G.M. Hospital campus. The prescriptions slips were taken in form of Xerox copy from the patients after taking the consent; the total 3587 prescriptions were analyzed for parameters like age and sex of patient; percentage of cardiovascular and antihypertensive drugs in prescriptions to patients that attend to OPDs and their order of preferences.

### Observations

In present study, total 3587 prescriptions were collected randomly from the patients visiting OPDs of S.G.M. Hospital, Rewa, MP and following observations were made.

## RESULTS

In present study total 3587 prescriptions were analyzed; most of the prescriptions were belongs to the age group of 33-42yrs (43.57%) followed by 23-32 (25.59%), >63 (11.45%), 13-22 (7.22%), 43-52 (6.88%), 53-62 (4.57%) and 0-12 (0.69%) yrs with their mean age ( $\pm$  standard deviation)  $37.78 \pm 13.36$  yrs. Fig.1 40.74% (1460) of these were males and 59.25% (2127) were females. Fig. 2 Of total studied prescriptions, maximum 34.54% (1239) prescriptions were belong to department of medicine followed by surgery 23.97% (860), orthopedics 13.9% (n=500), gynecology 11.59% (n=416), ENT 8.8% (n=316) and pediatrics 7.13% (n=256) in decreasing order. In 3587 prescriptions, total 8144 drugs were prescribed; of these only 4.19% (342) drugs were belonging to group of cardiovascular drugs. Amongst group of cardiovascular drugs; 94.73% (324) were belongs to antihypertensive and 5.26% (18) to ant-CHF (drugs) group. Most of the cardiovascular drugs were prescribed by the department of medicine 8.52% followed by surgery 1.8%, orthopedics 0.85% and pediatrics 0.64% (Table 1). 91.35% of these antihypertensive drugs were prescribed as monotherapy and rest 8.64% as combination therapy. Fig.3 Amongst the antihypertensive (n=324), the most frequently prescribed class was CCBs 35.49% (115) followed by ACEIs 25% (81),  $\beta$  blockers 13.27% (43), AT1 antagonist or ARBs 9.25% (30); combination therapy 8.64% (28) and diuretics 8.33% (27). Fig.4 In anti-CHF drugs, digoxin 5.26% (18) was the only prescribed drug in OPDs. There were no prescriptions that contained antiarrhythmic or antianginal drugs (Table 2). Amlodipine 83.47% (96) was most frequently prescribed CCBs followed by es-amlodipine 12.17% (14) and diltiazem 4.34% (5). Enalapril 60.49% (49) was most frequently prescribed ACE Inhibitors followed by ramipril 39.50% (32). Losartan 80.0% (24) was most frequently prescribed ARBs followed by candesartan 20.0% (6) or valsartan. Atenolol 69.76% (30) was the most frequently prescribed  $\beta$ -blockers followed by propranolol 18.60% (8) and metoprolol 11.62% (5) and hydrochlorothiazide 55.55% (15) was preferred over frusemide 44.44% (12) in diuretics. Amongst combination therapy; amlodipine+atenolol 46.42% (13) and losartan+ hydrochlorothiazide 46.42% (13) were equally prescribed compare to enalapril+ hydrochlorothiazide 7.14% (2). (Table 3)

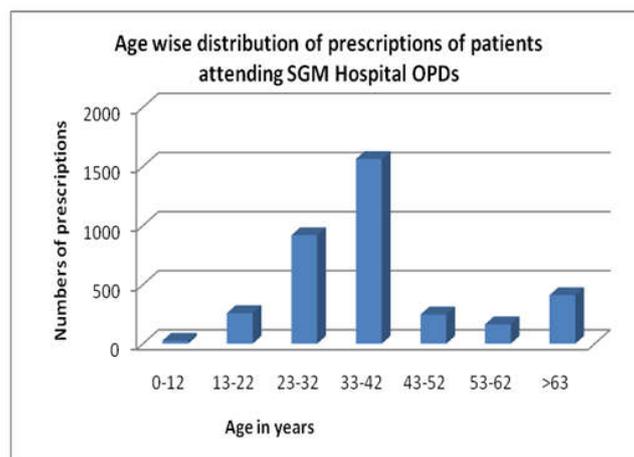
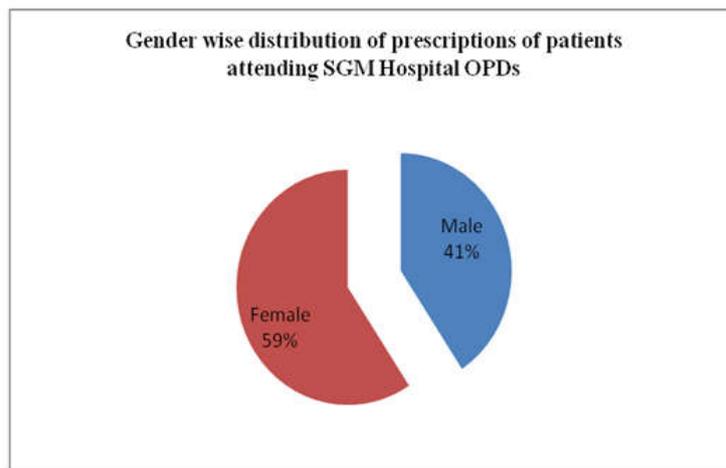


Figure 1. Age wise distribution of prescriptions of patients attending SGM Hospital OPDs



**Figure 2. Age wise distribution of patient prescriptions attending SGM Hospital OPDs**

**Table 1. Department wise distribution of no. of prescriptions, total no. of drugs and cardiovascular drugs prescribed in SGM Hospital**

S. No.	Name of Departments	Total no of prescriptions		Total no of prescribed drugs		Total no of prescribed cardiovascular drugs		Average no. of drug per prescription
		NO	%	NO	%	NO	%	
1.	Medicine	1239	34.54	3576	43.79	305 (n=3576)	8.52	2.88
2.	Surgery	860	23.97	1554	19.08	23 (n= 1554)	1.48	1.80
3.	Gynecology	416	11.59	517	6.34	NIL (n=517)	00	1.24
4.	Pediatrics	256	7.13	469	5.75	3 (n=469)	0.64	1.83
5.	Orthopedics	500	13.93	1284	15.76	11 (n=1284)	0.85	2.56
6.	ENT	316	8.81	743	9.12	NIL (n=743)	00	2.35
7.	Grand total (n=)	3587	100	8144	100	342 (n=8144)	4.19	2.27

**Table 2. Group wise prescribing frequency of cardiovascular (CVS) drugs in SGM Hospital OPDs**

S.No.	Class of CVS drugs	No of cvs drugs and percentage of cvs drugs												Grand total (n=342)		
		Medicine (n=305)		Surgery (n=23)		Gynecology		Pediatrics (n=3)		Orthopedic (n=11)		ENT				
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	
1.	Antihypertensive drugs	ACEIs	78	29.1	01	4.34	NIL	0	NIL	0	02	18.18	NIL	0	324	94.73
		Diuretics	20	9.01	02	8.69	NIL	0	3	100	02	18.18	NIL	0		
		Beta blockers	35	12.44	08	34.78	NIL	0	NIL	0	NIL	0	NIL	0		
		CCBs	109	33.9	02	8.69	NIL	0	NIL	0	04	36.36	NIL	0		
		ARBs	26	7.72	04	17.37	NIL	0	NIL	0	NIL	0	NIL	0		
		Combinations	19	6.23	06	26.08	NIL	0	NIL	0	03	27.27	NIL	0		
2.	Anti-CHF drugs	Digoxin	18	7.72	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	18	5.26
		Amidarone	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0
3.	Anti-anginal drugs	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	
4.	Anti-arrhythmic drugs	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	NIL	0	
TOTAL		305		23		0		3		11		0		342	100	

**Table 3. Frequency of antihypertensive drugs prescribed in SGM Hospital OPDs**

S.No.	Classes of drugs	Generic name	Number	Percentage (%)
1.		Enalapril	49	60.49
2.	ACEIs (n=81)	Ramipril	32	39.50
3.		Lisinopril	NIL	00
4.		Losartan	24	80.0
5.	ARBs (n=30)	Candesartan	06	20.0
6.		Irbesartan	NIL	00
7.		Amlodipine	96	83.47
8.	CCBs (n=115)	Esamlodipine	14	12.17
9.		Verapamil	NIL	00
10.		Diltiazem	05	4.34
11.		Propranolol	08	18.60
12.	Beta blockers (n=43)	Atenolol	30	69.76
13.		Metoprolol	05	11.62
14.		Diuretics (n=27)	Hydrochlorothiazide	15
15.		Frusemide	12	44.44
16.		Atenolol + Amlodipine	13	46.42
17.	Combinations (n=28)	Atenolol + Enalapril	NIL	00
18.		Losartan+Hydrochlorothiazide	13	46.42
19.		Enalapril+Hydrochlorothiazide	02	7.14
Total			324	

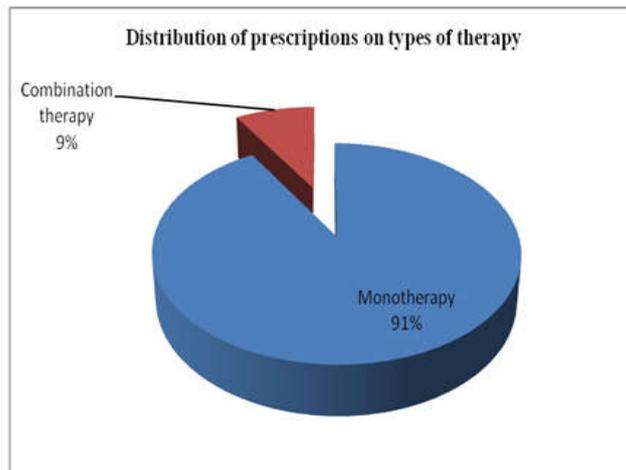


Figure 3. Distribution of prescriptions on types of therapy prescribed to patients attending SGM Hospital OPDs

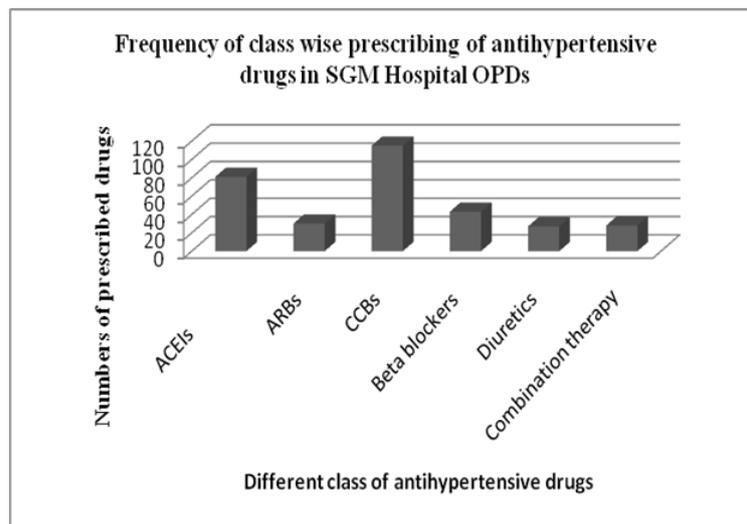


Figure 4. Frequency of class wise prescribed antihypertensive drugs in SGM Hospital OPDs  
 Frequency of individual drugs prescribing of antihypertensive drugs in SGM Hospital OPDs

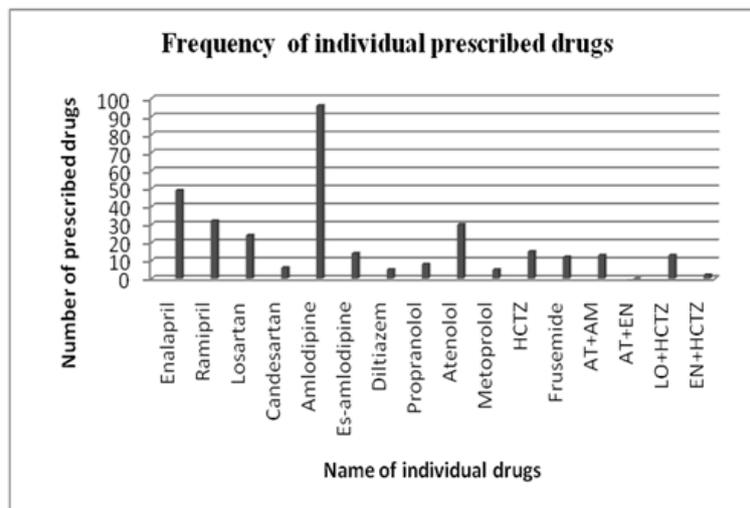


Figure 5. Frequency of individual antihypertensive drugs prescribed in SGM Hospital OPDs

However over all prescribing frequency amongst antihypertensive drugs were as follow; amlodipine (29.63%) followed by  $\geq$  enalapril (15.12%)  $\geq$  ramipril (9.87%)  $\geq$  atenolol  $\geq$  (9.25%)  $\geq$  losartan (7.40%) hydrochlorothiazide  $\geq$  (4.63%)  $\geq$  es-amlodipine (4.32%)  $\geq$  AT+AM (4.01%)= LO+HCTZ (4.01%)  $\geq$  frusemide (3.70%)  $\geq$  candesartan (1.85%)  $\geq$  metoprolol (1.54%) and others. Fig.5

## DISCUSSION

Because of the associated morbidity, mortality and the cost to society, hypertension is an important public health challenge. The general pattern of antihypertensive utilization appears to be in accordance with the guidelines of WHO and the Joint National Committee. This study was conducted to determine the frequency of antihypertensive use and prescribing pattern in a tertiary care hospital with uncomplicated essential hypertension. In our study; most of antihypertensive drugs were prescribed as monotherapy (91.35%) compare to combination therapy (8.64); this was similar to *Khaja et al.* study (2001) (in which 62.9% were on monotherapy and 37.1% were on combination therapy) and another study (Cheng, 2011), conducted in china (showed 62.9% patients were receiving monotherapy, 29.4% two drugs, 6.9% three drugs, and 0.8% were on four drugs) (Ker, 2010). However the study (Anju Madhwar *et al.*, 2015), conducted in Bareilly, U.P. shows dissimilar results to our study in which 70% patients were on combination therapy and only 30% were on monotherapy. In present study, amongst antihypertensive groups; CCBs were the most commonly prescribed (35.49%) drug followed by ACEIs >  $\beta$  blockers > AT1 antagonists > combination therapy and diuretics. This was similar to various other studies in which CCBs were most frequently prescribed, however; frequency of other drugs were different in all these study such as *Joseph et al* (2014), showed that calcium channel blockers were most frequently prescribed followed by diuretics,  $\beta$ - blockers,  $\alpha$ -blockers, ACE inhibitors, ARBs, vasodialators,  $\alpha$ + $\beta$  blockers and central sympatholytics. *Anand et al.* (2013) showed that calcium channel blockers were most frequently prescribed followed by diuretics (43.5%) > ACE inhibitors (29.5%) >  $\beta$  blockers (29%) and ARBs or AT1 receptor antagonists (21%). *Cheng et al* (2011) showed that calcium channel blockers were most frequently prescribed (58.0%) followed by ARBs (34.2%) > ACE inhibitors (17.5%) >  $\beta$ -blockers (16.9%) and diuretics (16.7%). However the various other studies showed the opposite results to our study such as *Clement et al.* (2012), study in which ACE inhibitors, particularly enalapril, was the most frequently prescribed antihypertensive (63.6%) followed by  $\beta$ -blockers, thiazide diuretics and calcium channel blockers and *Olanrewaju et al.* (2010), study in which diuretics (84%) were most frequently prescribed followed by CCB > ACEI >  $\alpha$ -methyl dopa >  $\beta$ -blockers and ARBs. However in *Khaja et al* study (Tasneem sandozi and Vamsi Krishna Emani, 2010),  $\beta$ -blockers were most frequently prescribed group followed by ACE inhibitors > calcium channel blockers > diuretics and alpha-methyl dopa were prescribed. In present study, within the class of various antihypertensive, amlodipine was most frequently prescribed calcium channel blockers similar to study (Anju Madhwar *et al.*, 2015; Tasneem Sandozi and Vamsi Krishna Emani, 2010) and enalapril was most frequently prescribed ACE

inhibitors, similar to study (Tasneem sandozi and Vamsi Krishna Emani, 2010; Rekha, 2014). The most frequently prescribed  $\beta$ -blockers were atenolol similar to study (Jassim, 2001 and Tasneem sandozi and vamsi krishna emani, 2010). Amongst diuretics, hydrochlorothiazide (HCTZ) 32.7%, was more commonly prescribed, this was similar to *Shukrala et al.* (2015) and *Clement et al.* (2012) study. However in individual drugs; amlodipine was most frequently prescribed followed by  $\geq$  enalapril  $\geq$  ramipril  $\geq$  atenolol  $\geq$  losartan  $\geq$  hydrochlorothiazide  $\geq$  es-amlodipine  $\geq$  AT+AM = LO+HCTZ  $\geq$  frusemide  $\geq$  candesartan  $\geq$  metoprolol and others.

## Conclusion

Hypertension (HTN) is an important public health challenge because of the associated high morbidity and mortality in the world population. There are number of antihypertensive drugs are available to treat and prevent the complications of hypertension. Amongst drugs acting on cardiovascular system CCBs were the most common prescribed antihypertensive followed by ACEIs >  $\beta$  blockers > AT1 antagonists or ARBs > combinations and diuretics in decreasing order and the digoxin is the only drug that was prescribed for treatment of CHF in OPDs of a tertiary care hospital. The most frequently prescribed CCBs was amlodipine, ACEIs was enalapril, ARBs was losartan,  $\beta$  blockers was atenolol and diuretics was hydrochlorothiazide. In combination therapy for hypertension; atenolol+ amlodipine and losartan+ hydrochlorothiazide was equally prescribed. Results of this study were shown that the pharmacotherapy of hypertension was given accordance with national and international guidelines (WHO/ISH guidelines) in appropriate manner.

## Abbreviations

HTN : Hypertension  
 CHF : Congestive Heart Failure,  
 ACEIs: Angiotensin Converting Enzyme Inhibitor,  
 ARBs : Angiotensin Receptor Blockers,  
 CCBs : Calcium Channel Blockers,  
 AT : Atenolol,  
 AM : Amlodipine,  
 LO : Losartan,  
 HCTZ : Hydrochlorothiazide.

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