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A study conducted on prescribing pattern and cost of anti-hypertensive drugs in a tertiary level hospital in South Malabar region of Kerala

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ABSTRACT

The main objective of the study is to assess the prescribing pattern of anti- hypertensive in a tertiary level referral hospital in south Malabar region of Kerala. Hypertension is a growing worldwide problem associated with an increased risk of cardiovascular morbidity and mortality. The rates of prevalence of hypertension are higher in some populations than others. Although ethnic and genetic factors have been implied in the past to explain this, the environmental influence and psychosocial factors may play a more important role. Examining the non-genetic influences in future hypertension research may be necessary in order to clearly define the local blood pressure demographics and the global hypertensive disease burden. In our study of drug prescribing patterns for hypertension in Al Shifa hospital, it was found that most patients were being treated with two or more drugs. Although β-blockers were the most frequently prescribed antihypertensive agents, CCBs and diuretics were prescribed sparingly. Among different classes of antihypertensive drugs specific drugs like atenolol, amlodipine, and furosemide occupied large proportion of the prescription. Newer and more expensive drugs, e.g. benazepril, ramipril, and losartan, were advised in a significant number of prescriptions, which added to the cost of drug treatment. Cost is being an important consideration for therapy of a chronic disease like hypertension, often requiring lifelong medication.

Key words: Hypertension, prescribing pattern, cost of drugs.

INTRODUCTION

Hypertension is an important public health challenge because of the associated morbidity and mortality and the cost to society [1]. It is estimated that the worldwide prevalence of hypertension would increase from 26.4% in 2000 to 29.2% in 2025 [2].

A number of drugs in various combinations are generally used for effective long-term management of hypertension.Therefore, drug utilisation studies, which evaluate,analyse the

medical, social and economic outcomes of the drug therapy, are more meaningful and observe the prescribing attitude of physicians with the aim to provide drugs rationally.[3]

MATERIALS AND METHODS

The study was conducted in the internal medicine outpatient department (OPD) of Al Shifa hospital, Perinthalmanna, a tertiary level referral hospital. Prescriptions of 100 patients with essential hypertension were studied. Only prescription written by consultant doctors were included, which were collected by team members from the internal medicine OPD. Hypertension was defined and staged according to the guidelines of the seventh report of the Joint National Committee (JNC VII) on prevention, detection, evaluation, and treatment of high blood pressure.[4]

The age and sex of patients, diagnosis (Including hypertension and other disease) and drugs prescribed were recorded. Brand names as well as generic names of prescribed drugs were noted. Cost of drugs was obtained from the Current Index of Medical Specialties (CIMS) [5]. Drug acquisition costs were calculated, using the cost of the cheapest available drug and the most commonly prescribed dosage, for each drug on a daily and annual basis. Total annual drug expenditure (money spent on buying required doses of all antihypertensive prescribed in the study population for a year) was also calculated. Drug expenditure due to a single drug was expressed as a percentage of total drug expenditure, e.g. drug expenditure due to a drug was calculated as:-

$$\frac{\text{Cost of daily treatment with a drug} \times \text{Number of prescriptions of the drug} \times 365}{\text{Total annual drug expenditure on antihypertensives. [6]}}$$

RESULTS AND DISCUSSION

Hypertension is a growing worldwide problem associated with an increased risk of cardiovascular morbidity and mortality. However, the rates of prevalence of hypertension are higher in some populations than others. Although ethnic and genetic factors have been implied in the past to explain this, the environmental influence and psychosocial factors may play a more important role. Examining the non-genetic influences in future hypertension research may be necessary in order to clearly define the local blood pressure demographics and the global hypertensive disease burden.

In India, hypertension (blood pressure ≥140 / 90 mmHg) is present in 25-30% of urban and 10-15% of rural adults. While stage II and high levels of hypertension (>160 / 100 mmHg) are present in 12-15% of urban and 5-7% of rural adults. These figures increase with age and prevalence rates of up to 51.8% have been reported in an elderly Indian population. Thus there is little doubt that hypertension is no longer a disease of the developed world alone. It is, therefore, important to lay stress on the optimal management of hypertension by making the best use of drugs available to us.

A total of 100 prescriptions for essential hypertension were studied. The major findings of our study are discussed below:-

I. Demographic profile of the study population.

a) Age

Patients were categorized into two groups. Patients of age group between 18-59 years were considered as adults and above 60 were geriatrics. In the present study 46 patients come under the category of adults and 54 patients were geriatrics.

Table-1: Age of the patients

Category	Number of patients
Adults (18-59 years)	46
Geriatrics (Above 60 years)	54

b) Gender

Sex had been a relevant factor in the clinical representation of hypertension.

Out of 100 patient 71 were men and 29 were women. The study findings indicate that hypertension was higher in males than females. Both stage-1 (23) and stage-II (48) hypertension were higher in males compared to females (stage-1 (14), stage-II (15)).

Table-2: Gender of the patients

Category	Stage- I (>140/90mmHg)	Stage - II (>160/100 mmHg)	Total
Male	23	48	71
Female	14	15	29

c) Staging of hypertension

Hypertension was staged according to the guidelines of the seventh report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure (JNC-VII). Out of 100 patients 37 patients suffered from stage-1 (>140/90mmHg) and 63 patients from stage-II (>160/100mmHg) hypertension.

Table-3: Stage of hypertension among patients

Category	Number
Stage-1 (>140/90mmHg)	37
Stage-2 (>160/100 mmHg)	63

d) Co-morbidities

A total of 14 patients had one or more concurrent diseases including DM (12) and asthma (2).

Table-4: Co-morbidities of the patients

Concurrent diseases	Number
Diabetes mellitus	12
Asthma	2

II. Drug treatment

The presence of concurrent diseases could influence the choice of antihypertensive drugs. The primary goal of antihypertensive therapy is to prevent morbidity and mortality related to hypertension. Selection of antihypertensive agents should therefore be based primarily on their comparative ability to prevent these complications.

a) Treatment of patients with hypertension and Diabetes mellitus (DM).

There were 12 patients with coexistent hypertension and type 2 DM (Table-5). All patients received AHA. Beta-blockers are largely not recommended in DM, because of their possible adverse effects on glucose metabolism. On the other hand, beta-blockers have shown long-term protective effects against cardiovascular disease in hypertensive patients, including those with DM. Two patients were on single agents (Metoprolol) and ten were receiving two or more drugs. All these patients received β_1-receptor selective β-blockers, i.e. atenolol or metoprolol. Beta-blockers (8), CCBs (7) and diuretics (4) were the most commonly used drugs in this group of patients. One patient was prescribed with an FDC (ACEI+D). One patient each received ATI antagonist and ACEI alone.

Table-5 : Treatment of patients with hypertension and Diabetes mellitus (DM)

Co-morbidity	Number	Drugs received	Number prescribed
DM	12	β –blockers	8
		CCBs	7
		Diuretics	4
		ACEI	1
		AT1Antagonist	1
		FDC [ACEI+ D]	1

b) Treatment of patients with hypertension and bronchial asthma.

There were only two cases of hypertension with asthma (Table-6). Both of them received diuretics (furosemide). No patient with bronchial asthma was prescribed by β–blockers.

Table-6: Treatment of patients with hypertension and bronchial asthma

Co-morbidity	Number	Drugs prescribed
Asthma	2	Furosemide

III. Antihypertensive prescribed

Among the patients prescribed with an antihypertensive, six patients received a single drug, while other patients were prescribed two or more drugs (counting a fixed dose combination [FDC] with two or more ingredients as two or more drugs).

Table 7(a) lists the drugs prescribed for hypertension in the study population. Beta-blockers were the most commonly prescribed drug group (58%, including FDCs), followed by CCBs (48%) and diuretics (42%). Atenolol (32%), amlodipine (28%) and enalapril (9%) were the most frequently used beta-blocker, CCB and ACEI respectively. Furosemide was the most commonly used diuretic. One of the patients received a thiazide diuretic as a single agent but six prescriptions contained thiazides as part of FDCs. Of 20 FDCs prescriptions (Table 7(b)), majority were a combination of β- blocker and CCB (7) or diuretic with either β-blocker (3) or CCB (3) or ACEI (3). The remaining FDCs were combinations of diuretics, AT-I with ACEI or beta blocker.

Table.7 (a): Antihypertensive prescribed

Drugs	Prescription (n=100)	Percentage
Single /Combination drugs		
β –blockers	**58**	**58%**
Atenolol	32	
Metoprolol	24	
Propranolol	2	
CCBs	**48**	**48%**
Amlodipine	28	
Nifidipine	12	
Diltiazem SR	2	
Felodipine	4	
Lacidipine FC	1	
Verapamil	1	
Diuretics	**42**	**42%**
Furosemide	37	
Hydrochlorothiazide	1	
Spiranolactone	4	
Others	**31**	**31%**
Losartan	21	
Prazosin	9	
Terazocine	1	
ACE inhibitor	**18**	**18%**
Enalapril	9	
Lisinopril	7	
Benazepril	1	
Captopril	1	
FDCs	**20**	**20%**
Atenolol + Nifidipine	4	
Enalapril + Hydrochlorothiazide	3	
Atenolol + Amlodipine	3	
Amiloride Hcl + Hydrochlorothiazide	2	
Losartan + Atenolol	2	
Atenolol+ Hydrochlorothiazide	1	
Metoprolol + Hydrochlorothiazide	1	
Spiranolactone + Furosemide	1	
Amlodipine + Hydrochlorothiazide	1	
Losartan + Ramipril	1	
Propranalol Hcl + Hydrochlorothiazide	1	

Table 7(b): Classes of FDC(Fixed Dose Combinations) prescribed

Classes	Total	Number of prescriptions
β -blocker + CCB	2	7
β- blocker + Diuretic	3	3
CCB + Diuretic	2	3
ACEI + Diuretic	1	3
AT1+ β-blocker	1	2
AT1+ ACEI	1	1
*2 Diuretics	1	1
* spirinolactone, furosimide		

Table 7(c): Drugs combinations used in treatment of hypertension

Drug combination	Number of prescription(n=100)	Percentage
2-drug combinations	**60**	**60**
β –blocker + CCB	13	13
AT1+ β-Blocker	10	10
β-Blocker + Diuretic	9	9
β-Blocker + ACEI	6	6
CCB + Diuretic	5	5
CCB + AT1	4	4
Diuretic + α-Blocker	3	3
CCB + ACEI	2	2
Diuretic + Diuretic	2	2
α-Blocker + ACEI	2	2
α-Blocker + β-Blocker	2	2
α-Blocker + CCB	2	2
3-Drug combinations	**27**	**27**
β-Blocker + Diuretic + CCB	6	6
CCB + Diuretic + ACEI	4	4
CCB + AT1+ β-Blocker	3	3
Diuretic + 2 β-Blockers	3	3
β-Blocker + Diuretic + AT1	3	3
β-Blocker + 2 CCBs	3	3
β-blocker + CCB + ACEI	3	3
β-Blocker + Diuretic + ACEI	2	2
4-Drug combinations	**7**	**7**
β-Blocker + ACEI+ AT1+ Diuretic	2	2
β-Blocker + Diuretic + CCB + AT1	2	2
β-Blocker + Diuretic + CCB + α-Blocker	1	1
CCB + AT1+ 2 Diuretics	1	1
ACEI + CCB + 2 Diuretics	1	1

Various drug combinations were used Table7(c) for treating 94 patients. Most of these (60% of total patients) were on two drug combinations, while 26% of the patients received three drug combinations, and 7% of the patients received four drugs. β-blocker with CCB (13%), β-blocker with ATI (10%), and β-blocker with diuretics (9%) were the most frequently used drug combinations.

IV. Cost of antihypertensive drugs

Table 8(a): **Daily and annual drug acquisition costs of antihypertensives**

Drug/Combination	Daily dose	Drug acquisition cost (Indian Rupees)		Total drug acquisition cost
		per day	per year	
Single drugs				
β –blockers				**47,016**
Atenolol	50 mg o.d	1.335	487	15,584
Metoprolol	25 mg b.d	3.446	1,258	30,192
Propranolol	50 mg b.d	1.7	620	1,240
CCBs				**47,763**
Amlodipine	5 mg o.d	2.680	978	27,384
Nifidipine	20 mg b.d	1.84	672	8,064
Diltiazem SR	30 mg b.d	4.25	1,551	3,102
Felodipine	5 mg o.d	5.47	1,997	7,988
Lacidipine FC	2 mg o.d	2.7	985	985
Verapamil	40 mg o.d	0.658	240	240
Diuretics				**8,657**
Furosemide	40 mg o.d	0.421	154	5,698
Hydrochlorothiazide	25 mg o.d	1.180	431	431
Spiranolactone	25 mg o.d	1.731	632	2,528
ACE inhibitor				**18,427**
Enalapril	2.5 mg o.d	1.59	580	5,220
Lisinopril	5 mg o.d	4	1,460	10,220
Benazepril	10 mg o.d	4.9	1,789	1,789
Captopril	25 mg o.d	3.283	1,198	1,198
Others				**29,216**
Losartan	25 mg o.d	1.3	475	9,975
Prazosin	2 mg o.d	4.25	1,551	13,959
Terazocine	2 mg o.d	1.731	5,282	5,282
FDCs				**22,726**
Atenolol + Nifidipine	1 tab o.d	3.15	1,150	4,600
Enalapril + Hydrochlorothiazide	1 tab o.d	3.025	1,104	3,312
Atenolol + Amlodipine	1 tab o.d	1.2	438	1,314
Amiloride Hcl + Hydrochlorothiazide	1 tab o.d	3.1	1,132	2,264
Losartan + Atenolol	1 tab o.d	6.5	2,373	4,746
Atenolol+ Hydrochlorothiazide	1 tab o.d	2.735	998	998
Metoprolol + Hydrochlorothiazide	1 tab o.d	2.971	1,084	1,084
Spiranolactone + Furosemide	1 tab o.d	2.615	954	954
Amlodipine + Hydrochlorothiazide	1 tab o.d	2.850	1,040	1,040
Losartan + Ramipril	1 tab o.d	5.24	1,912	1,912
Propranalol Hcl + Hydrochlorothiazide	1 tab o.d	1.375	502	502
Total - 1,73,805				

Table 8(b): Total expenditure on antihypertensive drugs

Drugs / Combinations	Individual cost (%)	Prescription (%)	Total expenditure (%)
β -blockers		**58%**	**27.05%**
Atenolol	8.96%		
Metoprolol	17.37%		
Propranolol	0 .713%		
CCBs		**48%**	**27.45%**
Amlodipine	15.75%		
Nifidipine	4.63%		
Felodipine	4.6%		
Lacidipine	0.56%		
Diltiazem	1.78%		
Verapamil	0.13%		
ACEIs		**18%**	**10.6%**
Enalapril	3%		
Lisinopril	5.88%		
Benazapril	1.02%		
Captopril	0.68%		
Diuretics		**42%**	**4.9%**
Furosimide	3.28%		
Hydrochlorothiazide	0.25%		
Spiranolactone	1.45%		
Others		**31%**	**16.81%**
Losartan	5.74%		
Prazosin	8.03%		
Terazosin	3.04%		
FDCs		**20%**	**13.08%**
Enalapril+Hydrochlorothiazide	1.91%		
Propranolol+Hydrochlorothiazide	0.28%		
Amiloride+Hydrochlorothiazide	1.30%		
Atenolol+Amlodipine	0.756%		
Atenolol+Nifidipine	2.64%		
Losartan+Atenolol	2.73%		
Atenolol+Hydrochlorothiazide	0.57%		
Metoprolol+Hydrochlorothiazide	0.623%		
Spiranolactone+Furosimide	0.548%		
Amlodipine+Hydrochlorothiazide	0.598%		
Losartan+Ramipril	1.1%		

The cost effectiveness is determined by the relationship between the benefits obtained for the expenditure. The two main determinant of cost-effectiveness are the cost of therapy and the initial cardiovascular risks of the patients. A total of 173,805 were spent in one year on drug acquisition for 100 patients of hypertension Table 8(a). Furosemide, verapamil were the least expensive agents followed by hydrochlorothiazide, losartan and atenolol. Terazocine, Felodipine, diltiazem and prazocin were the most expensive drugs. In FDCs Losartan + Atenolol, Losartan + Ramipril and Atenolol + Nifidipine were the most expensive drugs used. We found that some newer drugs such as lisinopril and benazepril which are much more expensive than the prototype (enalapril), were prescribed. Without significant clinical advantage over the newer drugs, they can probably be attributed to aggressive marketing of these agents, often combined with the prescriber's desire to keep up with the latest trends.

We found that ß-blockers, though used in 58% of the patients, accounted for only 27.05% of the annual drug expenditure because of their low cost Table 8(b). Their low cost, in addition to proven efficacy, cannot be ignored in a developing country like ours. CCBs also showed this favourable picture (48% of prescriptions and 27.45% of drug expenditure). ACEIs on the other hand, accounted for 10.6% of drug expenditure but were prescribed for only 18% of the patients. Diuretics constitute about 42% of the prescriptions; but they were responsible for only 4.98% of the total annual drug expenditure. Furosemide was one of the least expensive single agents used. FDCs were made up 20% of the prescription; they were attributed to 13.07% of the total drug expenditure.

An overview of totality of evidences suggests that the major classes of antihypertensives are equivalent in efficacy and safety. In most places, a diuretic is the cheapest of the option and is, therefore, most cost-effective. However, for certain compelling indications, other classes will provide additional benefits; even if they are more expensive, they may be more cost-effective.

CONCLUSION

In our study of drug prescribing patterns for hypertension in a tertiary level hospital in south malabar region of Kerala, we found that most patients were being treated with two or more drugs. Although β-blockers were the most frequently prescribed antihypertensive agents, CCBs and diuretics were prescribed sparingly. Among different classes of antihypertensive drugs specific drugs like atenolol, amlodipine, and furosemide occupied large proportion of the prescription. Newer and more expensive drugs, e.g. benazepril, ramipril, and losartan, were advised in a significant number of prescriptions, which added to the cost of drug treatment. Cost is being an important consideration for therapy of a chronic disease like hypertension, often requiring lifelong medication. So more serious consideration of available scientific evidence should go into writing a prescription for hypertension, especially in a developing country, to avoid unnecessary and expensive treatment.

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