

A study on cost analysis of various oral anti hypertensive drugs available in Indian market

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Abstract

Hypertension is one of the major risk factor for morbidities and mortalities associated with coronary heart disease, congestive heart failure, stroke and compromised renal function. It has become more common in developing countries like India. The prevalence of this disease in the year 2000 was 60.4 million males and 57.8 million females. Studies have shown that, the prevalence might still increase to 107.3 million males and 106.2 million females by the year 2025. Unlike that of previous misconceptions; regarding hypertension affecting only the urban population, now there is no disparity between the transition zones. The reason for this may be due to lack of awareness among patients, poor health care facility systems, lack of physicians to follow the standard treatment guidelines for management of hypertension, unhealthy life styles, non-compliance, poor dietary habits etc.

Keywords: Hypertension, Pregnancy, Diabetes.

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1. Introduction

Hypertension is one of the major risk factor for morbidities and mortalities associated with coronary heart disease, congestive heart failure, stroke and compromised renal function [1]. It has become more common in developing countries like India [2]. The prevalence of this disease in the year 2000 was 60.4 million males and 57.8 million females. Studies have shown that, the prevalence might still increase to 107.3 million males and 106.2 million females by the year 2025 [3]. Unlike that of previous misconceptions; regarding hypertension affecting only the urban population, now there is no disparity between the transition zones [4]. The reason for this may be due to lack of awareness among patients, poor health care facility systems, lack of physicians to follow the standard treatment guidelines for management of hypertension, unhealthy life styles, non-compliance, poor dietary habits etc [5].

Being a modifiable risk factor, hypertension should be diagnosed at an earlier stage and managed appropriately to prevent the onset of diseases which have major influence on mortality and quality of life [6]. Most of the patients diagnosed with hypertension require treatment with anti hypertensive drugs which has to be taken for a life time. Hence, the costs of these drugs in developing countries like India cause an important concern for the patients as well as physicians. The pharmaceutical industries in India represents USD 6 billion of the total worldwide market and is further increasing with a tremendous pace at a rate of 10% every year, ranking 4th & 13th by volume and in value respectively [7].

In India, most of the expenditures related to health care are paid by the patients unlike other developed countries where third party payers or government take responsibility of health care costs [8].

A developing country like India; with most of the patients affected belonging to lower socio economic strata, the cost of the drugs prescribed, plays an important role in medication adherence. The drug price control order (DPCO) is issued by the government of India to fix the prices of the drugs. The drugs included in DPCO have less price variation and are affordable as they cannot be priced beyond the charges fixed. In the year 1979, almost 80-85% of the drugs were under the drug price control order. But this was drastically reduced to 15-20% in the year 2002 [9]. This led to shelling out more money on over priced drugs due to huge price variation further increasing the economic burden to patients.

Recently 344 fixed dose combinations have been banned in India stating the availability of safer alternatives and increased risk of these drugs to humans. Newer drugs and fixed dose combinations are also being added periodically. This necessitates the conduct of cost analysis study, to provide knowledge to physicians regarding the cost of various drugs and thereby choosing the least expensive drugs among available alternatives.

Hypertension is a very common metabolic disorder accounting to highest out of pocket expenditure on antihypertensive drugs to around 64% in India [10]. Due to availability of very few pharmaco- economic studies in India, an attempt has been made to do cost analysis of various anti hypertensive drugs currently available in the Indian market.

Objectives:

- 1) To adumbrate the different oral antihypertensive drugs available in the market either singly or in combination and the number of brands marketed.
- 2) To evaluate the cost of different generic classes and brand names of the same compound used in hypertension.
- 3) To evaluate the difference in cost (price variation) of same drug marketed by different pharmaceutical companies with different brand names

2. Materials and methods:

This consequential observational analysis was done between January to April 2019, by the department of pharmacology, Saveetha Medical College and Hospital.

The drugs which are available orally for treatment of hypertension were listed from “Current Index of Medical Specialties” (CIMS) and “Indian Drug Review” (IDR) 2019 version [11].

The numerous pharmaceutical companies manufacturing drugs with different formulations were obtained and their costs were listed and compared.

As most of the brands sold 10 tablets in a strip, cost of 10 tablets for each drug formulation was noted. The minimum and maximum prices for each dose of drug among different formulations manufactured by different pharmaceutical companies were obtained and percentage cost variation was finally calculated using the formula [12,13]:

$$\frac{\text{Maximum Cost} - \text{Minimum Cost}}{\text{Minimum Cost}} * 100$$

Herbal drug preparations available for hypertension were not included in the study. Drug formulations manufactured by a single pharmaceutical company and fixed dose combinations containing more than 2 drugs were also excluded from the study.

3. Results

A total of 86 anti hypertensive drugs were analysed out of which 30 were single drug therapies and 56 of them were fixed dose combinations containing two drugs. The single drugs and fixed dose combinations were available in 318 and 285 drug formulations being marketed by different pharmaceutical companies under various brand names and prices.

The various single drug therapies used for hypertension, number of drug formulations, minimum cost, maximum cost and percentage variation in cost are shown in table-1. The percentage variation in cost of enalapril 2.5 mg, 5 mg and 10 mg is 88.46%, 87.79% and 139.27% respectively. Lisinopril- 2.5mg- 81.59%, 5mg- 89.54% and 10mg- 63.15%. For perindopril the percentage variation in cost is 70.50%, 163.92%, 160.04% and 65.43% for 1.25mg, 2.25mg, 5mg and 10mg respectively. Atenolol had price variation of 878%, 296.5%, 252.2% and 38.15% for 12.5mg, 25mg, 50mg and 100mg. Drugs like bisoprolol, felodipine, valsartan and furosemide had only one drug formulation and therefore percentage variation in cost could not be calculated. The percentage variation in carvedilol is 255.5%, 190.0%, 173.3% and 165.38% for 3, 125 mg, 6.25 mg, 12.5 mg and 25 mg respectively. Labetalol 100mg had price variation of 24.54%. Metoprolol 12.5mg, 25mg, 50mg and 100mg had price variation of 46.48% 117.33% 109.75% and 84.02%. Nebivolol 2.5mg - 229.68% and 5mg-125.29%. For Propranolol the cost variation was 106.06%, 191.50%, 416.34%, and 86.04% for 10mg, 20mg, 40mg and 80mg respectively. Amlodipine 2.5mg, 5mg and 10mg had price variation of 223.25% 409.67% and 194.84%.

Amlodipine, a calcium channel blocker is available in 64 drug formulations which is the maximum among all the available single drug therapies used for treatment of hypertension.

Table 1: Variation in cost of single drug therapy

S. No	Drug	Formulations	Dose (mg)	Min. Cost INR	Max. Cost INR	%variation in Cost
1	Enalapril	7	2.5mg	Rs.10.40	Rs.19.60	88.46%
			5mg	Rs.17.95	Rs.33.71	87.79%
			10mg	Rs.27.75	Rs.66.4	139.27%
2	Lisinopril	4	2.5mg	Rs.20.10	Rs.36.50	81.59%
			5mg	Rs.36.93	RS.70.00	89.54%
			10mg	Rs.66.50	Rs.108.50	63.15%
3	Perindopril	18	1.25mg	Rs.25.87	Rs.44.11	70.50%
			2.25mg	Rs.25.50	RS.67.3	163.92%
			5mg	Rs.46.00	Rs.119.62	160.04%
			10mg	Rs.142.9	Rs.236.40	65.43%
4	Atenolol	14	12.5mg	RS.2.00	Rs.19.57	878%
			25mg	Rs.5.80	Rs.23.00	296.5%
			50mg	Rs.6.55	Rs.23.07	252.29%
			100mg	Rs.25.71	Rs.35.57	38.15%
6	Carvediol	6	3.125mg	Rs.9.00	Rs.32.00	255.5%
			6.25mg	Rs.17.93	Rs.52.00	190.0%
			10mg	Rs.75.00	Rs.75.00	173.3%
			12.5mg	Rs.30.00	Rs.82.00	165.38%
7	Labetalol	2	100mg	Rs.110	Rs.137.00	24.54%
8	Metoprolol	32	12.5mg	Rs.22.87	Rs.33.50	46.48%
			25mg	Rs.19.50	Rs.42.38	117.33%
			50mg	Rs.28.60	Rs.59.99	109.75%
			100mg	Rs.67.00	Rs.123.30	84.02%
9	Nebivolol	8	2.5mg	Rs.32.00	Rs.105.50	229.68%
			5mg	Rs.50.20	Rs.113.10	125.29%
10	Propranolol	8	10mg	Rs.8.25	Rs.17.00	106.06%
			20mg	Rs.13.30	Rs.38.77	191.50%
			40mg	Rs.14.38	Rs.74.25	416.34%
			60mg	Rs.59.00	Rs.59.00	86.04%
11	Amlodipine	64	2.5mg	Rs.8.30	Rs.26.83	223.25%
			5mg	Rs.9.30	Rs.47.40	409.67%
			10mg	Rs.26.21	Rs.77.28	194.84%
12	Clindipine	8	5mg	Rs.25.00	Rs.49.50	197.3%
			10mg	Rs.29.50	Rs.78.00	164.40%
			20mg	Rs.49.50	Rs.119.00	140.40%
13	Diltiazem	10	30mg	Rs.17.40	Rs.36.57	110.17%
			60mg	Rs.29.31	Rs.74.40	153.83%
			90mg	Rs.32.00	Rs.99.00	209.37%
			120mg	Rs.40.00	Rs.171.40	328.50%
			180mg	Rs.75.50	Rs.221.00	192.70%
240mg	Rs.90.60	Rs.140.00	54.52%			
15	Nifedipine	8	5mg	Rs.10.80	Rs.12.30	13.8%
			10mg	Rs.8.64	Rs.19.39	124.4%
			20mg	Rs.18.00	Rs.26.58	47.6%
			30mg	Rs.18.42	Rs.260	1311%
16	S-amlodipine	7	1.25mg	Rs.47.00	Rs.76.66	63.10%
			2.25mg	Rs.14.50	Rs.82.85	471.3%
			5mg	Rs.23.00	Rs.141.85	516.73%
17	Candesartan	2	4mg	Rs.27.81	Rs.34.95	25.67%
			8mg	Rs.45.27	Rs.61.8	36.51%
18	Losartan	31	25mg	Rs.15.50	Rs.34.90	125.1%
			50mg	Rs.29.50	Rs.85.85	191.01%
19	olmesartan	18	10mg	Rs.65.20	Rs.77.30	18.5%
			20mg	Rs.34.00	Rs.171.50	404.4%
			40mg	Rs.54.00	Rs.187.70	247.59%
20	Telmisartan	45	20mg	Rs.55.65	Rs.27.82	100%
			40mg	Rs.100.50	Rs.27.00	272.2%
			80mg	Rs.115.00	Rs.74.95	53.4%
24	Prazosin	2	2.5mg	Rs.80.1	Rs.114.1	42.44%
			5mg	Rs.107	Rs.125.3	17.10%
25	Acetazolamide	2	250mg	Rs.34.86	Rs.52.35	
27	Hydrochlorothiazide	2	12.5mg	Rs.6.00	Rs.8.70	45%
			25mg	Rs.11.00	Rs.14.5	31.8%
28	Metalazone	2	2.5mg	Rs.59.50	Rs.66.35	11.5%
			5mg	Rs.90.50	Rs.115.32	27.42%
29	Torasemide	6	5mg	Rs.15.95	Rs.27	69.2%
			10mg	Rs.21.38	Rs.40	87.09%
			20mg	Rs.44.28	Rs.76.3	72.31%
30	Indapamide	4	100mg	Rs.148.50	Rs.287	93.2%
			1.5mg	Rs.37.50	Rs.125.30	234.1%

Table 2 : Variation in cost of combination therapy

S. No	Drug combination	Formulations (n)	Dose (mg)	Min. cost INR	Max. cost INR	% variation in cost
2	Amlodipine + enalapril	4	5mg+5mg	Rs.45.90	Rs.72.66	54.06%
3	Amlodipine+ lisinopril	7	5mg+5mg	Rs.9.30	Rs.101.50	991.30%
4	Enalapril+Hydrochlorothiazide	2	10mg+25mg	Rs.32.00	Rs.34.50	7.80%
5	Lisinopril+ Hydrochlorothiazide	3	5mg+12.5mg	Rs.10.00	Rs.93.40	834%
8	Ramipril+ Amlodipine	4	2.5mg+5mg 5mg+5mg	Rs.78.00 Rs.101.50	Rs.94.54 Rs.147.57	21.20% 45.30%
10	Ramipril+ Hydrochlorothiazide	8	2.5mg+12.5mg 5mg+12.5mg 10mg+12.5mg	Rs.45.00 Rs.93.00 Rs.218.12	Rs.101.19 Rs.164.77 Rs.218.12	124.8% 77.1% -
11	Amlodipine+atenolol	41	5mg+50mg 5mg+25mg	Rs.15.30 Rs.27.00	Rs.91.3 Rs.63.00	496.73% 133.3%
15	Atenolol+Nifedipine	1	50mg+20mg	Rs.38.50	Rs.87.31	126.70%
16	Metoprolol+Amlodipine	8	25mg+5mg 50mg+5mg 25mg+2.5mg	Rs.55.00 Rs.42.50 Rs.29.00	Rs.113.1 Rs.139.07 Rs.93.35	105.63% 227.2% 221.8%
20	Nebivolol+S-amlodipine	2	5mg+2.5mg	Rs.62.46	Rs.110.50	76.91%
21	Nebivolol+HC	6	5mg+12.5mg	Rs.54.76	Rs.169.70	209.89%
22	Amlodipine+Telmisartan	10	5mg+40mg 5mg+80mg	Rs.42.43 Rs.115	Rs.118.00 Rs.189.50	178.1% 64.78%
23	Amlodipine+HC	4	2.5mg+12.5mg	Rs.22.24	Rs.77	246.20%
24	Amlodipine+Olmesartan	2	5mg+20mg 5mg+40mg	Rs.117.00 Rs.102.48	Rs.175.50 Rs.258	50% 151.7%
25	Amlodipine+ Indapamide	2	2.5mg+1.5mg	Rs.85.70	Rs.115.0	34.18%
30	Amlodipine+Enalapril	4	5mg+5mg	Rs.45.90	Rs.72.66	58.30%
31	Amlodipine+lisinopril	7	5mg+5mg	Rs.9.30	Rs.101.50	991.30%
32	Amlodipine+losartan	14	5mg+25mg 5mg+50mg	Rs.39.00 Rs.33.00	Rs.68.00 Rs.114.50	74.3% 256.06%
33	Cilnidipine+Chlorthalidone	2	10mg+12.5mg 10mg+6.25mg	Rs.85.91 Rs.77.25	Rs.101.00 Rs.79.00	17.56% 2.2%
34	Cilnidipine+Metopril	2	10mg+50mg	Rs.79.50	Rs.104.57	31.53%
37	Losartan+ HC	28	25mg+12.5mg 50mg+12.5mg	Rs.28.50 Rs.36	Rs.50.00 Rs.105.68	75.45% 193.5%
41	Losartan+Atenol	2	50mg+50mg	Rs.60.00	Rs.126.28	110.40%
43	Olmesartan+Chlorthalidone	4	20mg+6.25mg 20mg+12.5mg 40mg+12.5mg	Rs.81.00 Rs.85.70 Rs.152.70	Rs.88.00 Rs.114.50 Rs.204.00	8.6% 33.6% 33.5%
44	Olmesartan+HC	9	20mg+12.5mg 40mg+12.5mg	Rs.58.50 Rs.99.00	Rs.151.20 Rs.300.00	158.4% 203.03%
45	Metoprolol+Olmesartan	2	25mg+20mg 50mg+20mg	Rs.119.74 Rs.126.80	Rs.124.00 Rs.138.90	3.5% 9.5%
48	Torasemide+spirinolacton	8	10mg+50mg 20mg+50mg 5mg+50mg	Rs.36.00 Rs.53.00 Rs.36.00	Rs.58.00 Rs.63.49 Rs.48.00	61.1% 19.79% 33.33%
50	Telmisartan+HC	47	40mg+12.5mg 80mg+12.5mg	Rs.40.00 Rs.69.50	Rs.134.8 Rs.223.7	237% 221.8%
51	Telmisartan+Chlorthalidone	15	40mg+6.25mg 40mg+12.5mg 80mg+12.5mg	Rs.51.70 Rs.37.50 Rs.132.13	Rs.117.00 Rs.120.00 Rs.195.00	126.3% 220% 47.5%
52	Telisartan+Clonidipine	3	40mg+10mg	Rs.85.00	Rs.210.00	147.05%
53	Telisartan+Metoprolol	3	40mg+25mg 40mg+50mg	Rs.91.00 Rs.90.00	Rs.119.20 Rs.145.90	30.9% 61.5%
54	Telisartan+Ramipril	3	40mg+5mg 40mg+2.5mg	Rs.80.00 Rs.69.65	Rs.104.75 Rs.75.00	30.93% 7.68%

Among the fixed dose combinations for hypertension management, telmisartan + hydrochlorothiazide and amlodipine + atenolol was available in maximum number of drug formulations- 47 and 41 in number respectively.

4. Discussion

Indian market sells different drugs of same dosage under different brand names which also varies in prices over a wide range. Majority of the patients in India are

illiterate and do not have any idea on the brands available. It is hence the duty of the general practitioner to select an appropriate drug based on cost and effectiveness. Many pharmacists do not give the brands prescribed by the practitioner and sell other alternatives suggesting the non availability of the prescribed brand of drug as reason. This is mainly done to get more margin of profit from few brands. These might lead to economic implications in a developing country like India as costlier drugs are prescribed when cheaper alternatives exist. It is therefore

the responsibility of the registered health care practitioner to have an idea of various formulations available and selecting the least cost effective drug among them.

In India, very few studies have been done on cost analysis. Hypertension being the most common condition for increased out of pocket expenses in India and requiring lifelong treatment with drugs, we attempted to carry out this study. In this study, we obtained a detailed list of various single and fixed dose combination of anti hypertensive drugs, different formulations and their price list from CIMS version 2019.

From this study, we can perceive that most of the drugs used for hypertension have a high price variation of around 100% which is an unnecessary burden to the drug consumers. Among the single drug therapies nifedipine 30 mg has the highest percentage variation in cost of 1131% followed by atenolol 12.5 mg with a price variation of

878%. Among drug combinations available, amlodipine (5mg) + lisinopril (5 mg) followed by lisinopril (5 mg) + hydrochlorothiazide (12.5 mg) has the highest price variation of 991% and 834% respectively. However, the findings of this study differs considerably from that of similar study done by Karve *et al* who reported amlodipine 5mg and amlodipine (5mg) + atenolol (50 mg) to have the highest price variation of 1128.57% and 673.79% in single drug and fixed dose combinations respectively [14]. It also differed from the study conducted by Kamath *et al* who reported Amlodipine 2.5 mg – 1040.58% and Atenolol + Hydrochlorothiazide (50 + 12.5 mg) -504.82% to have the highest price variation among single and combination treatments [15].

From our study the suggestions to syncope the prices of drugs at national and international level are tabulated in table 3 [13].

Table 3: Suggestions to syncope the prices of drugs at national and international level

At National Level
<ul style="list-style-type: none"> To incorporate more number of drugs in essential drug list/ national list of essential medicines and make them approachable to general public To subsidize the prices of drugs by including more number of drugs under drug price control order (DPCO) Strict regulatory measures to pare down irrational combinations and encourage rational prescribing among general practitioners Formulating and effectuating standard treatment guidelines at all health care levels
At International Level
<ul style="list-style-type: none"> Do assessment based on needs and frame drug therapeutic committee Encouraging use of drugs by generic names only Avoiding irrational drug combinations and promoting use of rational and essential fixed dose combinations Prioritizing certain anti hypertensive drugs to make it reachable for all To improve free supply of drugs at primary health care level Awareness and educational measures to the practitioners to select the most cost effective drug Measures to educate the patients to adhere to prescribed medicine and not switch over to other brand without consulting the physician

5. Conclusion

This study highlights that there are many formulations available for treatment of hypertension with huge price variation. Hence, educational, ethical, regulatory and rational prescribing has to be followed to curtail the variation in cost. This study provides the various antihypertensive formulations with prices of drugs for health care professional to choose the best cost effective drug. This will decrease the economic burden on the society and increase patient adherence. To bring down the prices of drugs, the government has to take measures to revise and include many drugs under the Drug price control order (DPCO).

Conflict of interest: None declared

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