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## PHARMACOECONOMIC COMPARISON OF TELMISARTAN AND AMLODIPINE IN HYPERTENSIVE POSTMENOPAUSAL WOMEN

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### ABSTRACT

Angiotensin Receptor Blockers (ARBs) and calcium channel blockers (CCBs) are commonly prescribed antihypertensive agents in post menopausal women (PMW). However, the cost effectiveness of these drugs in alone has not been examined before in India. Therefore, the aim of this study was to evaluate the cost-effectiveness of Telmisartan versus amlodipine in the management of hypertension among hypertensive postmenopausal women. A prospective observational study was conducted in Department of General Medicine at Karuna Medical College Hospital, Palakkad for a period of October 2019 to September 2020. PMW with self reported cessation of menstruation for >12 consecutive months with or without co morbid diseases, newly diagnosed and treated for hypertension were included. These two drugs were found to be equieffective in reducing the blood pressure to the target goal, but the cost of reducing 1 mm of Hg systolic blood pressure (SBP) reduction was found to be 68.93 INR and 37.81 INR and distolic blood pressure (DBP) reduction with 106.57 INR and 76.58 INR in Telmisartan and Amlodipine group respectively. Hence the cost incurred in treating hypertension

was markedly lower with the Amlodipine group as compared to the Telmisartan group. This pharmacoeconomic evaluation study shows that Amlodipine is more cost-effective as compared to Telmisartan when the cost per mm Hg reduction in SBP and DBP were considered. In India the cost of drug is a significant factor to patient compliance, cost-effective therapy of hypertension is most importance.

**Keywords: Pharmacoeconomics, Telmisartan, Amlodipine, Post-menopausal women, Cost effectiveness**

## INTRODUCTION

Menopause is the permanent end of menstruation due to the depletion of functional and viable ovarian follicles and it is a physiological part of ageing that is said to occur 12 months after a woman's last menstrual period. It occurs between 45-50 years of age, the average age of menopause being 47 years [1]. After the menopause, Cardio vascular disease (CVD) is the prime cause of death in women and incidence increases further with increasing age and particularly post-menopausal women (PMW) comprise more than 30% of the women affected with CVD in India [2]. A 50-year-old woman has a 50% chance of developing CVD, and a 30% chance of dying from it during the postmenopausal periods [3].

Hypertension (HTN) is a major contributor to morbidity and mortality worldwide and is highly prevalent in elderly women. However, few studies to date have evaluated changes in blood pressure (BP) across the menopausal transition [4]. In

worldwide prevalence of hypertension between 2000 and 2025 was predicted to increase by 9% in males and 13% in females. In many low-income and middle-income countries, it has been considered a major public health concern [5]. Hypertension accounts for 10% of worldwide healthcare expenditure under lining the considerable economic implications to resource constrained health systems. In 2004, the annual income loss from NCDs among working adults in India was INR 251 billion (about US\$ 50 billion) and that due to hypertension alone amounted to INR 43 billion. It has been estimated that less than 20% of hypertensive patients have adequate control of blood pressure [6].

BP control is the single most important intervention to reduce the risk of future CV events in women [7]. Drug utilization studies showed diuretics were used by 44.3% of post menopausal hypertensives either as monotherapy or in

combination with other drug classes and as monotherapy, calcium channel blockers (CCBs) were used in 16%, angiotensin-converting enzyme inhibitors (ACEIs) in 14%, b-blockers in 9%, and diuretics in 14% of the hypertensive women [8]. The failure to continue on a particular drug therapy was identified as the most representative type of noncompliance because half the subjects exposed to discontinue treatment within a few months [9].

ACEIs/Angiotensin Receptor Blockers (ARBs) and CCBs are commonly prescribed antihypertensive agents that are used as a monotherapy in the management of HTN in PMW. However, the cost effectiveness of this antihypertensive medications used in alone has not been examined before in India. Therefore, the aim of this study was to evaluate the cost-effectiveness of Telmisartan versus amlodipine in terms of systolic blood pressure (SBP) and diastolic blood pressure (DBP) reductions when used as monotherapies in the management of hypertension among hypertensive postmenopausal women.

## METHODOLOGY

**Study Design:** A prospective observational study.

**Study Site:** Department of General Medicine at Karuna Medical College Hospital, Palakkad for a period of one year (October 2019 to September 2020).

**Inclusion criteria:** Post menopausal hypertensive women with self reported cessation of menstruation for >12 consecutive months with or without co morbid diseases, Patients with HT in stage I/ stage II, Newly diagnosed and treated for hypertension.

**Exclusion criteria:** Post menopausal women who was done hysterectomy, oophorectomy, women with indeterminate menopausal status, Patients with Systolic Blood Pressure (SBP) >210 and/or Diastolic Blood Pressure (DBP) >120 mm Hg requiring emergency care.

## Study Procedure

Patients were assessed for the changes in the BP with a follow-up of over a period of 12-weeks. Patients were assessed at the time of screening (baseline), then after the 12 weeks run-in period (follow up). In each assessment visits, both SBP and DBP were measured in the sitting, standing, and lying position using a standardized procedure. Patients were subjected to thorough history, clinical examination, and biochemical investigations. During screening at first visit, patients were examined

completely with due consideration to medical history, family history, socioeconomic history, past history, and addiction history. Patients were examined physically to record the anthropometric measurements, body mass index, and vital signs.

A total of 80 hypertensive postmenopausal women were then randomly divided into two groups. One group was treated with Telmisartan 40 mg once daily and the other group received Amlodipine 5mg once daily. The selection of doses of these two agents was based on previous studies and caused almost equal reduction of BP in patients. Hence the two doses are considered equi-effective. The baseline data were carried out before the initiation of therapy and after twelve weeks of completion of treatment. The hypertensive postmenopausal women under treatment were periodically monitored and re-assessed at regular follow-up for evaluation of BP reduction or control and entire the study period BP <140/90 mm Hg was targeted.

### Cost Analysis

In pharmacoeconomics, cost effective analysis was performed. The cost of the both drug therapies drug therapies were calculated as a function of the dosage prescribed and the price in current index of medical specialties. The cost was expressed in currency. Two

different brands of Telmisartan and Amlodipine were available in our hospital pharmacy supply. The overall cost of each drug was estimated as the mean cost of that drug. Effectiveness of each drug was taken as the average reduction in SBP, DBP values. The cost-effectiveness was calculated by using incremental cost for per mmHg reduction and cost for per patient attaining BP goal were calculated.

$$\text{ICER} = \frac{\text{Cost of A} - \text{Cost of B}}{\text{Effect of A} - \text{Effect of B}}$$

### Statistical Analysis

The values of SBP and DBP were evaluated by intra group comparisons made between the values obtained from baseline and follow up. These values were statistically evaluated by a repeated measures students t test by using graphpad prism. Results of changes in SBP and DBP were expressed as mean  $\pm$  standard deviation of the mean. The confidence interval was kept at 95% and  $P < 0.05$  indicated a statistically significant association.

### RESULTS

A total number of 80 (Telmisartan (n=44) & Amlodipine (n=36)) hypertensive postmenopausal women were enrolled in the study. They received treatment with either Telmisartan (40mg OD) or Amlodipine (5mg OD). The baseline characteristics of patients

were given in **Table 1**. Majority of the patients were in the age group of 46-50 years.

The average age of the patients with telmisartan group was  $52.71 \pm 09.15$  years and amlodipine group with  $56.30 \pm 11.04$  years. Distribution of comorbid diseases were compared in both groups. Diabetes mellitus is more prone to compare than dyslipidemia. There is no significant difference in both groups according to comorbid diseases. BMI wise distribution in both groups showed that, most of the patients come under obesity ( $n=18$  &  $n=14$ ) and overweight ( $n=13$  &  $n=11$ ).

**Table 2** showed that overall mean (SD) changes in SBP and DBP in both groups. In the Telmisartan-treated group, the mean SBP prior to treatment  $148.44 \pm 12.08$  mmHg and after 12 weeks of therapy, the mean SBP was  $141.22 \pm 11.14$  mmHg and the mean DBP prior to treatment was  $90.88 \pm 7.33$  mmHg and after 12 weeks of therapy, the mean DBP was  $86.21 \pm 6.37$  mmHg respectively. There was statistically significant reduction in SBP and DBP after 12 weeks of therapy in Telmisartan group ( $p < 0.05$ ) when compared with the baseline readings.

In the Amlodipine-treated group, the mean SBP prior to treatment was  $152.51 \pm 13.96$  mmHg. After 12 weeks of

therapy, the mean SBP was  $146.14 \pm 12.04$  mmHg and the mean DBP prior to treatment was  $90.28 \pm 10.06$  mmHg and after 12 weeks of therapy, the mean DBP was  $87.12 \pm 9.03$  mmHg respectively. There was statistically significant reduction in SBP after 12 weeks of therapy in Amlodipine group ( $p < 0.05$ ) and there was no significant reduction in DBP when compared with the baseline readings. We found that, the mean SBP reduction was  $7.22 \pm 0.94$  mmHg and DBP reduction with  $4.67 \pm 0.96$  mmHg in Telmisartan group and mean SBP reduction was  $6.4 \pm 1.92$  mmHg and DBP reduction with  $3.16 \pm 1.03$  mmHg in Amlodipine group.

The comparative cost evaluation of different equivalent doses of the two drugs is presented in **Table 3**. The total cost of treatment of Telmisartan group was Rs. 497.7 and Amlodipine group was Rs. 242 for the entire study duration of 12 weeks. Cost comparison and evaluation showed that the cost required for a 1 mmHg reduction in SBP and DBP for Telmisartan group was 7.22 INR and 6.4 INR, whereas in Amlodipine group was Rs.4.67 INR and 3.16 INR. Thus, at equivalent doses, the cost for an equivalent reduction in SBP and DBP was markedly less for the Amlodipine group as compared to the Telmisartan group. The number of hypertensive PMW attaining the goal BP

(<140/90 mm Hg according to JNC VIII criteria) were compared between the two regimens. Telmisartan group (82%) patient reached the goal more compare than Amlodipine group (76%).

**Table 4**, showed the Incremental Cost Effectiveness Ratio between the two regimens. Cost per mmHg SBP reduction was found to be 68.93 INR and 37.81 INR and DBP reduction with 106.57 INR and 76.58 INR in Telmisartan and Amlodipine group respectively. ICER was calculated by dividing the difference in the cost of treatment of both the groups to difference in

effectiveness in reduction of SBP and DBP of both the groups. Its value comes out to be Rs. 37.95 for SBP and Rs. 19.86 for DBP. i.e. In the Telmisartan group to reduce the SBP by one mm Hg additional cost of Rs. 37.95 and DBP reduction by Rs. 19.86 has to be paid by the patient. It can therefore be assumed that in cases of Hypertension, it is exclusively the drug price rather than the effectiveness/efficacy, which is more important determinant of cost-effectiveness. In this result showed that, Telmisartan group patient receive more cost compare than Amlodipine group for same outcome.

**Table 1: Baseline Characteristic of study population**

S. No.	Parameters	Telmisartan (n=44)	Amlodipine (n=36)	P value
1	Age (mean±SD)	52.71 ± 09.15	56.30±11.04	0.1157
2	Age in groups (in years)			0.7756
	40-45	3	4	
	46-50	18	12	
	51-55	9	6	
	56-60	8	10	
	>60	6	4	
3	Comorbid Disease			0.7903
	Diabetes mellitus	16	12	
	Dyslipidemia	8	5	
4	Body mass index (kg/m <sup>2</sup> )			0.9087
	Underweight (<18.5)	2	3	
	Normal weight (18.5-24.9)	11	8	
	Overweight (25.0-29.9)	18	14	
	Obese (>30)	13	11	

**Table 2: Effect of Telmisartan/Amlodipine in SBP and DBP among study population**

S. No.	Parameters	Baseline	Follow up	BP Reduction	P value
1	Amlodipine (n=36)				
	SBP in mmHg (mean ±SD)	152.51±13.96	146.14±12.04	6.4±1.92	0.0418*
	DBP in mmHg (mean ±SD)	90.28±10.06	87.12±9.03	3.16±1.03	0.1652
2	Telmisartan (n=44)				
	SBP in mmHg (mean ±SD)	148.44±12.08	141.22±11.14	7.22±0.94	0.0045**
	DBP in mmHg (mean ±SD)	90.88 ±7.33	86.21±6.37	4.67±0.96	0.0020**

\*P<0.05, \*\*P<0.01

Table 3. Cost effectiveness analysis of two regimens based on SBP and DBP

S. No.	Drugs	Total cost of therapy	Average SBP reduction (mm Hg)	Average DBP reduction (mm Hg)	% of patients achieved target	Cost/Target BP
1	Telmisartan	497.7	7.22	4.67	82	6.06
2	Amlodipine	242	6.4	3.16	76	3.18

Table 4. Incremental cost effectiveness ratio. (ICER)

S. No.	Drugs	Telmisartan	Amlodipine	Difference in cost	Difference in effectiveness	ICER
1	Cost/mm Hg SBP reduction	68.93	37.81	31.12	0.82	37.95
2	Cost/mm Hg DBP reduction	106.57	76.58	29.99	1.51	19.86

## DISCUSSION

Hypertension is a important issue in public health and its associated clinical conditions like CVD, place a great socioeconomic burden on the society [10, 11]. It is always an importance to prescribe the drugs which are at low costs to reduce the overall healthcare expenditure and the economic burden on the hypertensive patients [12]. The important tool in making therapeutic decision in case of chronic diseases like diabetes with hypertension and to assess the value of treatments, to compare the medical cost and health outcomes associated with new therapies/medicines to the cost is the pharmacoeconomic evaluations which have grown ahead where there are limited sources [13, 14].

The effective management of HT in women is essential for prevention of stroke and myocardial infarction. So the early detection and treatment of BP using the most effective and affordable antihypertensive

medication is important. Previous study resulted that ACEIs/ARBs were shown to be more effective with reasonable incremental cost in managing essential HTN in comparison to amlodipine [15].

In the present study also we noted that both the Temisartan and Amlodipine caused almost equal magnitude of fall in SBP as well as DBP, hence the equal antihypertensive efficacy between the two groups can be well accounted for. The another study showed that, two drugs were found to be equieffective in reducing the BP to the target goal, at their respective equivalent doses but the cost of reducing 1 mm of Hg mean blood pressure with Losartan was 103.42 INR, whereas that of Amlodipine was 57.11 INR. Hence the cost incurred in treating elevated BP was markedly lower with the Amlodipine group as compared to the Losartan group. Amlodipine is more cost-effective as compared to Losartan when the cost per mm

Hg reduction in mean BP is considered. Hence in India, where the cost of drug is a significant deterrent to patient compliance, cost-effective therapy of hypertension is of most importance [16]. As per our study Amlodipine was a cost effective drug for the management of hypertension in post menopausal women. It is considered a first-line antihypertensive agent and has good efficacy and safety, in addition to strong evidence from large randomised controlled trials for cardiovascular event reduction [17].

## CONCLUSION

This pharmacoeconomic evaluation study showed that Amlodipine was more cost-effective as compared to Telmisartan when the cost per mm Hg reduction in SBP and DBP are considered. Hence in India, where the cost of drug is a important factor to patient compliance, cost-effective therapy of chronic disease like hypertension is of most important in particularly post menopausal women.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance No:** KMC/IHEC/10/2019

## REFERENCE

[1] Singla R, Singh H, Gupta AK, Sehgal VK. A study of anti-hypertensive drug prescription patterns in hypertensive post- menopausal

women. *Int J Med and Dent Sci* 2018; 7(1):1594-1603.

- [2] Garg B *et al.* cardiovascular disease risk in pre and postmenopausal women. *Pak J Physiol* 2017; 13(2).
- [3] Bhavik Prajapati, Shirish Raval, Jigar Patel, Ishwar Parmar, Janak Chokshi, Nilay Thakore. A study of clinical profile of cardiovascular manifestations in postmenopausal women. *IAIM*, 2018; 5(4): 100-106.
- [4] Son M K *et al.* Difference in blood pressure between early and late menopausal transition was significant in healthy Korean women. *BMC Women's Health*: 2015; 15:64.
- [5] Wang J, Jiang Sharma M, et al. Sex differences in antihypertensive drug use and blood pressure control. *Postgrad Med J*.2019;**95**:295–299.
- [6] Limaye D *et al.* Cost-effectiveness study of antihypertensive drugs in Mumbai, India. *Ijlr*: 2018;8(1):97-103.
- [7] N Engberding and NK Wenger. Management of hypertension in women. *Hypertension Research*, 2012; 35:251–260.
- [8] Smoller SW *et al.* Hypertension and Its Treatment in Postmenopausal

- Women. Hypertension. 2000; 36:780-789.
- [9] Esposti L D *et al.* Pharmacoeconomics of antihypertensive drug Treatment: an analysis of how long patients remain on various anti hypertensive therapies. The journal of clinical hypertension, 2004; 4(2): 76-84.
- [10] Dhivya PS, Swathy G, Pal S. Pharmacoeconomics of anti-hypertensive drugs prescribed in a multispecialty hospital in South India. Asian J Pharm 2014; 8:178-82.
- [11] Tsuji RLG *et al.* An economic evaluation of antihypertensive therapies based on clinical trials. Clinics 2012;67(1):41-48.
- [12] Smitha V.K *et al.* Pharmacoeconomic Evaluation of Anti-Hypertensive Therapy. BBRC 2021; 14 (2): 489-92.
- [13] Rana R, Modupalli A, Suresh A, Mamidi S, Anusha B, Trivedi S. Pharmacoeconomical evaluation of hypertension with diabetes mellitus in a teaching hospital in urban Bangalore. Int J Basic Clin Pharmacol 2016; 5: 473-7.
- [14] Solanki N D and Patel P. Utilization pattern and pharmaco-economic analysis of Antihypertensive drugs prescribed in secondary care hospital in Gujarat, India. Asian J Pharm Clin Res, 2017; 10 (3): 120-124.
- [15] AlRuthia, Y *et al.* Cost Effectiveness of ACEIs/ARBs versus Amlodipine Monotherapies: A Single-Center Retrospective Chart Review. Healthcare 2021; 9: 798.
- [16] Iram S, Singh HK. Pharmacoeconomic comparison of losartan and amlodipine in patients of hypertension in a tertiary care teaching hospital. Int J Basic Clin Pharmacol., 2017; 6:552-8.
- [17] Fares H, DiNicolantonio JJ, O'Keefe JH, *et al.* Amlodipine in hypertension: a first-line agent with efficacy for improving blood pressure and patient outcomes. Open Heart 2016;3:e000473.