Evaluation of Antihypertensive Drug Prescription Patterns, Rationality, and Adherence to Joint National Committee-8 Hypertension Treatment Guidelines among Patients Attending Medicine OPD in a Tertiary Care Hospital

Chandra Narayan Gupta1, Akul SK2, Sugata Mahapatra3, Apala Lahiri4, Kausik Maji5, Sukanta Sen6

ABSTRACT

Introduction: The increasing prevalence of hypertension is attributed to population growth, ageing and behavioural risk factors, such as unhealthy diet, harmful use of alcohol, lack of physical activity, excess weight and exposure to persistent stress. The present study was conducted to study on various facets of antihypertensive drugs prescribing at present scenario at Dr. B.C. Roy Hospital, Haldia, and with objectives of studying prescribing patterns and rationality of antihypertensive drugs in essential hypertension with or without specific co-morbid conditions and to check compliance of treatment as per JNC-8 hypertension treatment guidelines in the outpatients attending the Department of Medicine.

Material and Methods: Data regarding anti-HTN monotherapy and combination therapy was recorded. Evaluation for rational drug therapy by evaluating average number of drugs per prescription, fixed dose combination (FDC) prescription rate, prescription laying down importance of lifestyle management, prescription with defined anti-HTN goals, prescriptions with correct dose strength and dosage schedule was evaluated.

Results: Out of 100 hypertensive patients under evaluation 67 was males (67%) with a M:F ratio of 2.03:1. Mean SBP was slightly higher in male patients. Hypertension was classified according to JNC-8 guidelines and found 22 (22%) (Pre-hypertension/pre-HTN), 57 (57%) (Stage 1 hypertension), and 13% (stage 2 hypertension) cases. Dyslipidemia was noted much more common associated disorders among newly diagnosed hypertensive of either sex.

Conclusion: Diuretics (8%) were most widely prescribed drugs followed by ARBs (6%), ACE Inhibitors (5%) and calcium channel blockers (4%) as monotherapy. Adherence of JNC 8 guidelines among all study hypertensive participants while prescribing medications varied between 62% to 92%, with an average of 75%. None of the prescriptions mentioned ban drug formulation(s). Still 15% of the prescriptions had suggested combined drugs with debated rationality formulations.

Keywords: Antihypertensive Drug Prescription Patterns, Rationality, Joint National Committee-8, Hypertension Treatment Guidelines, Patients Attending Medicine OPD

INTRODUCTION

Hypertension is defined as a systolic blood pressure (SBP) of 140 mm Hg or more, or a diastolic blood pressure (DBP) of 90 mm Hg or more, or taking antihypertensive medication.1 Globally, an estimated 26% of the world’s population (972 million people) has hypertension, and the prevalence is expected to increase to 29% by 2025.2 HTN exerts a substantial public health burden on cardiovascular health status and healthcare systems in India. Blood pressure control is essential to prevent end-organ complications, such as stroke, myocardial infarction, heart failure, or kidney disease.3 Hypertension (HTN) is the most common condition seen in primary health care setting and leads to myocardial infarction, stroke, renal failure, and death if not detected early and treated appropriately. There are significant health and economic gains attached to early detection, adequate treatment and good control of hypertension. High blood pressure (BP) is ranked as the third most important risk factor for attributable burden of disease in south Asia (2010).4 In 2008, worldwide, approximately 40% of adults aged 25 and above had been diagnosed with hypertension; the number of people with the condition rose from 600 million in 1980 to 1 billion in 2008.5 Study had shown that HTN is directly

1Associate Professor, Department of General Medicine, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, 1Final MBBS Student, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, 1Intern, Department of General Medicine, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, 1House Staff, Department of General Medicine, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, 1Professor & HOD, Department of General Medicine, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, 1Professor & HOD, Department of Pharmacology, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, India

Corresponding author: Dr. Sukanta Sen, Professor & HOD, Department of Pharmacology, ICARE Institute of Medical Sciences and Research, Banbishnupur, Purba Medinipur, Haldia, West Bengal, India

How to cite this article: Chandra Narayan Gupta, Akul SK, Sugata Mahapatra, Apala Lahiri, Kausik Maji, Sukanta Sen. Evaluation of antihypertensive drug prescription patterns, rationality, and adherence to joint national committee-8 hypertension treatment guidelines among patients attending medicine OPD in a tertiary care hospital. International Journal of Contemporary Medical Research 2019;6(10):J31-J37.

DOI: http://dx.doi.org/10.21276/ijcmr.2019.6.10.42
Patients want to be assured that HTN treatment will reduce their disease burden, while clinicians want guidance on hypertension management using the best scientific evidence. However, their use in decision making in clinical practice is largely neglected by physicians. Patients want to be assured that HTN treatment will reduce their disease burden, while clinicians want guidance on hypertension management using the best scientific evidence. Keeping in view, the present study will be conducted to study on various facets of antihypertensive drugs prescribing at present scenario at Dr. B.C. Roy Hospital, Haldia, a tertiary care teaching hospital and with objectives of studying prescribing patterns and rationality of antihypertensive drugs in essential hypertension with or without specific co-morbid conditions and to check compliance of treatment as per JNC-8 hypertension treatment guidelines in the outpatients attending the Department of Medicine.

MATERIAL AND METHODS

A cross-sectional, observational study was carried out in the Outpatient Department of Medicine, in Dr. B.C. Roy Hospital associated with ICARE Institute of Medical Sciences & Research, Haldia, West Bengal for 3 months. Permission from the Institutional Ethics Committee was obtained before starting research work. Subjects and their accompanying family members were interviewed by pre-structured questionnaire, and past and present prescriptions and case notes, where available, was reviewed. All decisions relating to management of the patient including drugs and investigations was taken by the treating physician only. Investigator did not interfere in the management of patient and only observed the proceedings.

Antihypertensive drugs were categorized according to the eighth report of the JNC on prevention, detection, evaluation, and treatment of high blood pressure (JNC-8). Data regarding anti-HTN mono-therapy and combination therapy was recorded. Evaluation for rational drug therapy by evaluating average number of drugs per prescription, fixed dose combination (FDC) prescription rate, prescription laying down importance of lifestyle management, prescription with defined anti-HTN goals, prescriptions with correct dose strength and dosage schedule was evaluated. Number of prescriptions mentioning duration of therapy, over prescribing, banned drug formulation, debated rationality or irrational combinations, generic, and brand names used was also captured. The prescriptions was collected by an me by clicking the picture by mobile outside the medical outpatient department and interviewing the HTN patients without the knowledge of prescriber to avoid any bias after taking verbal consent and after due administrative and Institutional Ethics Committee permission.

Inclusion criteria

1. Subjects who was suffering from essential hypertension and prescribed antihypertensive at Medicine O.P.D.
2. Patients from all age groups and both the sexes will be included
3. Hypertensive patients with co-morbidities like diabetes mellitus, ischemic heart diseases, congestive heart failure and chronic renal diseases will also be included in the study
4. Those who understood the purpose of the study and are ready to provide information regarding their health status and those who signed an informed consent document.

Exclusion criteria

1. Subjects not agreeing to participate
2. Suffering from any serious disease such as hypertensive emergencies, unstable coronary heart disease, acute myocardial infarction, acute left ventricular failure, advanced kidney or liver failure, and cerebral stroke
3. Any condition resulting in severe learning disability (e.g. brain injury) or
4. Those unable to comprehend for other reasons will be excluded from the study.

A total of 100 hypertensive patients was studied because time and facility constraints. The study was commenced after obtaining approval from institutional ethics committee and was continued for a span of 3 months in the Medicine Out-Patient Department (OPD) of Dr. B. C. Roy Hospital, Haldia, West Bengal. Data was analyzed at the end of study.
All statistical calculations were performed using Statistical Package for Social Science (SPSS), version 20.0. Data were expressed in n (%). A P-value of <0.05 was considered as statistically significant.

RESULTS

One hundred prescriptions were collected randomly in the duration of 3 months to assess medication adherence as per JNC 8 guidelines among Indian hypertensive patients attending Medicine OPD of a tertiary care teaching hospital, Haldia, West Bengal. The demographic and clinical characteristics were shown in Table 1. Out of 100 hypertensive patients under evaluation 67 was males (67%) with a M:F ratio of 2.03:1. Mean age among male participants was less (55.29±16.48) in comparison to female hypertensive (59.30±11.55). Mean SBP was slightly higher in male patients. Majority of the hypertensive patients in either sex was in the 40-60 yrs age group followed by age group above 60 years. The highest number of male hypertensive patients 40 (59.7%) [n=67] belonged to the age group of 40-60 years while the highest number of female hypertensive patients 17 (51.51%) [n=33] belonged to the age group of 40-60 years suggesting the earlier onset of hypertension in males than in females in this particular area where the study has been conducted (Table 1).

In male patients stage 1 HTN was observed in 55.22% followed pre-HTN (22.38%) and stage 2 HTN (13.43%). In female participants it was observed that stage 1 HTN (60.60%) followed by pre-HTN (21.21%) and stage 2 HTN (12.12%) [Table 1]. Hypertension was classified according to JNC-8 guidelines and found 22 (22%) (Pre-hypertension/ pre-HTN), 57 (57%) (Stage 1 hypertension), and 13% (stage 2 hypertension) cases. The mean systolic blood pressure was 151.8±18.68 mm Hg (males) and 150.4±16.03 mm Hg (females) (Table 1).

Diabetes mellitus (11.94%, males; 12.12%, females), other cardiovascular diseases (8.95%, males; 18.18%, females), acid peptic disease (23.88%, males; 27.27%, females), obesity (11.94%, males; 18.18%, females), and dyslipidemia (40.29%, males; 42.42%, females) are the most common co-morbidities in hypertension patients (Table 2/Fig. 1). Dyslipidemia was noted much more common associated disorders among newly diagnosed hypertensive of either sex.

| Characteristics                        | Males [n=67] | Females [n=33] | P value |
|----------------------------------------|--------------|----------------|---------|
| Age (Mean ± SD)                        |              |                |         |
| <40 years                              | 55.29±16.48  | 59.30±11.55    | 0.2132  |
| 40-60 years                            | 08 (11.94%)  | 03 (9.09%)     | 0.6700  |
| Above 60 years                         | 04 (5.97%)   | 17 (51.51%)    | 0.4390  |
| Systolic Blood Pressure (Mean ± SD) [mm Hg] |              |                |         |
| Normal (<120 mmHg), n (%)              | 06 (8.95%)   | 02 (6.06%)     | 0.6181  |
| Pre HTN (120-139 mmHg), n (%)          | 05 (7.46%)   | 03 (9.09%)     | 0.7786  |
| Stage 1 HTN (140-159 mmHg), n (%)      | 04 (13.43%)  | 04 (12.12%)    | 0.8554  |
| Stage 2 HTN (≥160 mmHg), n (%)         | 09 (13.43%)  | 05 (15.15%)    | 0.2484  |
| Diastolic Blood Pressure (Mean ± SD) [mm Hg] |              |                |         |
| Normal (<80 mmHg), n (%)               | 03 (7.46%)   | 03 (9.09%)     | 0.7786  |
| Pre HTN (80-89 mmHg), n (%)            | 04 (12.12%)  | 04 (12.12%)    | 0.9793  |

Table-1: Baseline demographic and clinical characteristics of hypertensive patients (n=100).

| Co-morbidities                | Male [n=67] | Female [n=33] | Total [n=100] | Percentage (%) |
|------------------------------|-------------|---------------|---------------|----------------|
| Diabetes Mellitus            | 08 (11.94%) | 04 (12.12%)   | 12 (12%)      | 12             |
| Other Cardio vascular disease| 06 (8.95%)  | 06 (18.18%)   | 12 (12%)      | 12             |
| Renal diseases               | 05 (7.46%)  | 02 (6.06%)    | 07 (7%)       | 7              |
| Liver Diseases               | 02 (2.98%)  | 01 (3.03%)    | 03 (3%)       | 3              |
| Hypothyroidism               | 03 (4.47%)  | 02 (6.06%)    | 05 (5%)       | 5              |
| Hyperthyroidism              | 02 (2.98%)  | -             | 02 (2%)       | 2              |
| Lung disorders               | 05 (7.46%)  | 02 (6.06%)    | 07 (7%)       | 7              |
| Acid peptic disease          | 16 (23.88%) | 09 (27.27%)   | 25 (25%)      | 25             |
| Obesity/overweight           | 08 (11.94%) | 06 (18.18%)   | 14 (14%)      | 14             |
| Dyslipidemia                 | 27 (40.29%) | 14 (42.42%)   | 28 (28%)      | 28             |
| Other diseases               | 12 (17.91%) | 05 (15.15%)   | 17 (17%)      | 17             |

Table-2: Co-morbid conditions among hypertensive subjects
Table 3 shows the mono and combination therapies for the treatment of hypertension. As per present study, most of the physicians prescribed two-drug combination (35%) to control BP followed by monotherapy (29%), three-drug combination (11%) and four-drug combination (2%). Diuretics (8%) are most widely prescribed drugs followed by ARBs (6%), ACE Inhibitors (5%) and calcium channel blockers (4%) as monotherapy. In some cases beta blockers (2%) and alpha agonists (1%) also prescribed. Monotherapy of nitrates was also documented in 2% cases.

Two drugs regimen was prescribed in 35% of the hypertensive patients. ACE inhibitor(s) + diuretics combination (8%) was mostly used in two drug combination therapy followed by angiotensin receptor blockers + diuretics combination (6%) and ACE inhibitors + dihydropyridine calcium channel blockers (5%). There was different other combinations also prescribed in the hypertensive patients with or without co-morbidities like dihydropyridine calcium channel blockers + β-blockers (2%), calcium channel blockers + ARBs (4%), Diuretics + β-blockers (2%), ACEs/ARBs + β-blockers (2%), diuretics + diuretics [potassium sparing diuretics with thiazides] (2%) and calcium channel blockers + alpha agonists (1%). None of the hypertensive patients was prescribed ACEs + ARBs, β-blocker + central acting (clonidine) and β-blocker + non-dihydropyridine CCB in combination [Table 3].

Three antihypertensive drugs regimen was prescribed in 11% of the hypertensive patients. Three drugs combination as an antihypertensive was mainly tried CCBs+ ACEIs/ARBs+ Diuretics (5%) followed by ACEIs/ARBs + BBs + CCBs (3%), and ARBs + Diuretic + Diuretic (2%). In few prescriptions (2%) it was also observed that four drugs regimen like ARBs+ Diuretics+ CCBs combinations (1%) also prescribed in uncontrolled hypertensive patients (Table 4). Majority of the patients were prescribed combination anti-HTN drugs with other drugs (78%) may be due to address associated co-morbidities.

Among the combination therapy olmesartan/amlopidine/HCTZ, valsartan/amlopidine/ (hydrochlorothiazide) HCTZ, candesartan/HCTZ, losartan/HCTZ, olmesartan/HCTZ, telmisartan/HCTZ, metoprolol tartrate/HCTZ, amlopine + atenolol, amlopine + losartan, amlopine + enalapril, metoprolol tartrate/HCTZ, spironolactone/HCTZ, atenolol+ chlorthalidone, nebivolol + HCTZ, enalapril + HCTZ, lisinopril + HCTZ, ramipril + HCTZ e, telmisartan + HCTZ also prescribed in the hypertensive patients with or without co-morbidities like dihydropyridine calcium channel blockers + β-blockers (2%), calcium channel blockers + ARBs (4%), Diuretics + β-blockers (2%), ACEIs/ARBs + β-blockers (2%), diuretics + diuretics [potassium sparing diuretics with thiazides] (2%) and calcium channel blockers + alpha agonists (1%).

### Table 3: Antihypertensive medications used by hypertensive patients (males and females) in mono and combination therapies

| Treatment | No., Percentage [n=100] |
|-----------|--------------------------|
| Mono-therapy | 29 (29%) |
| ACE Inhibitors (ACEIs) | 5 (5%) |
| Angiotensin Receptor Blocker (ARBs) | 6 (6%) |
| Diuretics | 8 (8%) |
| Calcium Channel Blockers | 4 (4%) |
| Beta Blockers | 2 (2%) |
| Alpha Blockers | 01 (1%) |
| Alpha 2 Agonists | 01 (1%) |
| [potassium sparing diuretics with thiazides] | 0 |
| Calcium channel blockers + ARBs | 4 (4%) |
| ACEs/ARBs + β-blockers | 2 (2%) |
| Calcium channel blockers + α-agonists | 1 (1%) |
| Alpha Blockers + Diuretics | 1(1%) |
| ACEs + ARBs | 0 |
| β-blocker + central acting (clonidine) | 0 |
| β-blocker + nondihydropyridine CCB | 0 |
| Three Drugs Regimen | 11 (11%) |
| CCBs + ACEIs/ ARBs + Diuretics | 5 (5%) |
| ARBs + Diuretic + Diuretic | 2 (2%) |
| ACEs/ARBs + BBs + CCBs | 3 (3%) |
| ACEs/ARBs + BBs + Diuretics | 1 (1%) |
| Four Drugs Regimen | 02 (2%) |
| Diuretics + Calcium channel blockers + β-blockers | 1 (1%) |
| Angiotensin receptor blockers + diuretics + Calcium channel blockers | 1 (1%) |

### Table 4: Adherence to JNC-8 hypertension treatment recommendations

| Recommendations | Non-adherence rate (%) | Adherence rate (%) | P-Value |
|----------------|------------------------|-------------------|---------|
| Recommendation 1 | 22% | 78% | < 0.0001 |
| Recommendation 2 | 35% | 65% | < 0.0001 |
| Recommendation 3 | 25% | 75% | < 0.0001 |
| Recommendation 4 | 39% | 61% | < 0.0001 |
| Recommendation 5 | 27% | 73% | < 0.0001 |
| Recommendation 6 | 08% | 92% | < 0.0001 |
| Recommendation 7 | - | - | - |
| Recommendation 8 | 12% | 88% | < 0.0001 |
| Recommendation 9 | 24% | 76% | < 0.0001 |
| Recommendation 10 | 38% | 62% | < 0.0001 |
| Average | 25% | 75% | < 0.0001 |
and losartan + hydrochlorothiazide were found maximally prescribed in our study population. Amlodipine+ HCTZ + telmisartan, amlodipine + HCTZ + olmesartan and amlodipine + HCTZ + telmisartan + metoprolol were the frequently prescribed triple and four drug combinations, respectively. No combination of ACEIs + ARBs was prescribed in any prescription. A comparison of residents’ adherence by specialty to each JNC 8 guideline recommendation is presented in Table 4. Adherence of JNC 8 guidelines among all study hypertensive participants while prescribing medications varied between 62% to 92%, with an average of 75%. The least adherence (61%) was to recommendation 4 and 10 to initiate pharmacologic treatment in the population aged ≥ 18 years with chronic kidney disease to lower BP to goal of less than 140/90 followed by 62% adherence if goal BP cannot be reached with 2 drugs, add and titrate a third drug from the list provided. None of the patients was prescribed ACEI and an ARB together. However, 73% of the prescriptions were adherent to recommendation 5 to initiate pharmacologic treatment in the diabetes population. The overall rate of adherence was 06/22 (27.27%) in pre-hypertension; 92% in stage 1 hypertension; and 78% in stage 2 hypertension patients. Almost 100% adherence rate among the patients of hypertensive emergency and urgency with the JNC 8 guidelines was noticed. The rationality of prescription pattern of anti-hypertensive was also evaluated. The average number of drugs prescribed to each patient was 4-6 (64%). About 88% prescriptions had stressed importance of lifestyle management. About 225 of the prescription did not defined antihypertensive goals. None of the prescriptions mentioned ban drug formulation(s). Still 15% of the prescriptions had suggested combined drugs with debated rationality formulations. Only 6% of the prescription mentioned generic names of medicines. FDCs were prescribed more (83%) than 17% of combined prescribed drug(s) [Table 5].

**DISCUSSION**

Hypertension is a chronic disease requiring lifelong treatment. This observational study analysed the prescribing pattern in hypertensive patients and its adherence with JNC 8 guidelines for the management of hypertension, attending the outpatient department of General Medicine at Dr B C Roy Hospital, Haldia, West Bengal. Choice of an antihypertensive drug should be driven by likely benefit in an individual patient, taking into account concomitant diseases such as diabetes mellitus, problematic adverse effects of specific drugs, and cost. The overall goal of treating hypertension is to reduce hypertension associated morbidity and mortality.12 Out of 100 hypertensive patients in present study 67 was males (67%) with a M:F ratio of 2.03:1. Mean age among male participants was less (55.29±16.48) in comparison to female hypertensive (59.30±11.55). The results of this study in line with study by Romday R e al (2016)13 which suggests that hypertension is more prevalent in males (59.8%), compared to females (40.2%). The above pattern is analogous to studies conducted by (Jhaj et al14; Malhotra et al15; Kothari et al16; Murti et al17) in India and Jeannette Sessoms et al (2015)18 in African Americans. However the above pattern is anomalous to other studies conducted by (Tiwari et al19; Surapaneni et al20) in India, Pittrow et al21 in Germany and Lee et al22 in China have reported higher prevalence of hypertension in females than in males. This study also reveals that hypertension is more prevalent in elderly patients belonging to age group 40-60 or more. Study conducted by Romday et al13 and Tiwari et al19 found most common age group 50-59 years (33.3%) followed by 60-69 years and 40-49 years (26.7%). Present study results showed diabetes mellitus (11.94%, males; 12.12%, females), other cardiovascular diseases (8.95%, males; 18.18%, females), acid peptic disease (23.88%, males; 27.27%, females), obesity (11.94%, males; 18.18%, females), and dyslipidemia (40.29%, males; 42.42%, females) are the most common co-morbidities in hypertension patients. Dyslipidemia was noted much more common associated disorders among newly diagnosed hypertensives of either sex. Present study results fall in line of the study by Romday R et al (2016).13 Study done by Amira et al23 and Kothari et al24 found 36.6% and 47.72% patients respectively were suffering with comorbid conditions. Sakhri S et al25 reported diabetes mellitus (35%) as the most frequent co-morbidity followed by asthma (5%) and ischemic heart disease (6.6%). Kothari N et al, reported majority of the patients were suffering from hypertension with diabetes mellitus (37.49%) followed by other associated conditions like ischemic heart diseases (7.12%), congestive heart failure (2%), and chronic kidney diseases (1.11%).16 Pai et al reported diabetes mellitus (47.5%), ischemic heart disease (16.5%), renal diseases (7.5%) and cardiovascular

| Rationality parameters | Non-adherence rate (%) | Adherence rate (%) | P-Value |
|------------------------|------------------------|--------------------|---------|
| Prescription rate stressing importance of lifestyle management | 12% | 88% | < 0.0001 |
| Prescription rate with defined antihypertensive goals | 22% | 78% | < 0.0001 |
| Dose strength mentioned rate | - | 100% | - |
| Dose schedule mentioned rate | - | 100% | - |
| Ban drug formulation prescription rate | - | 0% | - |
| Debated rationality formulation prescription rate | 85% | 15% | < 0.0001 |
| Generic versus brand name prescription rate | 6% | 94% | < 0.0001 |
| Fixed dose combination versus combination prescription rate | 83% | 17% | < 0.0001 |

**Table-5: Evaluation of rational drug therapy**
As per present study, most of the physicians prescribed two-drug combination (35%) to control BP followed by monotherapy (29%), three-drug combination (11%) and four-drug combination (2%). Diuretics (8%) are most widely prescribed drugs followed by ARBs (6%), ACE Inhibitors (5%) and calcium channel blockers (4%) as monotherapy. In some cases beta blockers (2%) and alpha agonists (1%) also prescribed. Monotherapy of nitrates was also documented in 2% cases.

Two drugs regimen was prescribed in 35% of the hypertensive patients. ACE inhibitor(s) + diuretics combination (8%) was mostly used in two drug combination therapy followed by angiotensin receptor blockers + diuretics combination (6%) and ACE inhibitors + dihydropyridine calcium channel blockers (5%). It also shows that most frequently prescribed classes of drugs are thiazides alone or in combination. Since the eighth report of Joint National Committee (JNC 8) on detection, evaluation prevention and treatment recommends the use of ACEIs, ARBs, thiazide diuretic, and CCBs alone or in combination for the management of early stage hypertension, thus suggesting that the above trend is in conformity to the recommendations of JNC 8 guidelines. Hence this drug utilization data corroborates adherence to JNC 8 guidelines. However, the results of current study were not fully in accordance to the study of Tiwari et al as far as drug prescription rate of BBs is concerned. ACE inhibitors and ARBs prescription rates in their study were almost in comparison to present study. This might be because of recently gained popularity of ARBs and ACEIs. In combination therapy, a two drug combination consisting of BBs and CCBs was given to the majority of the patients like our study. The study of Dhanaraj et al recorded highest prescription rates of ACE inhibitors (59%) followed by ARBs (52%), CCBs (29%), diuretics (27%), and BBs (14%). Thiazides were the most preferred agents used, either as monotherapy or combination therapy in hypertensive patients with or without comorbidities in accordance to our study.

Adherence of JNC 8 guidelines among all study hypertensive participants while prescribing medications varied between 62% to 92%, with an average of 75%. The least adherence (61%) was to recommendation 4 and 10 to initiate pharmacologic treatment in the population aged ≥ 18 years with chronic kidney disease to lower BP to goal of less than 140/90 followed by 62% adherence if goal BP cannot be reached with 2 drugs, add and titrate a third drug from the list provided. None of the patients was prescribed ACEI and an ARB together. However, 73% of the prescriptions were adherent to recommendation 5 to initiate pharmacologic treatment in the diabetes population.

The overall rate of adherence was 06/22 (27.27%) in pre-hypertension; 92% in stage 1 hypertension; and 78% in stage 2 hypertension patients. Almost 100% adherence rate among the patients of hypertensive emergency and urgency with the JNC 8 guidelines was noticed.

Drugs are often used in combination to achieve a preferred therapeutic goal or to treat coexisting diseases. Because of the risk related to concomitant use of drugs, co-medication has become a general concern and an important concept in term of prescribing appropriateness. Some combinations may result in undesired pharmacodynamic or pharmacokinetic interactions, resulting in under-treatment or harmful effects. The consequences of drug-drug interactions (DDIs) can range from no untoward effects at all, to drug-related mortality. Strengths and Limitations of the Study

Our study supports the usefulness of the awareness to an adherence model and affords valuable information on the implementation of an important guideline in India. This study had some limitations also. Data were collected from only one institution, therefore population is relatively homogenous. Due to small sample size, variability and vagueness should be noted as limitations. A larger sample size would produce more detailed, robust, and explanatory assessments. Large studies involving heterogeneous population are required. Secondly, the study was conducted during only the summer months and over a short duration. Extending the study period and expanding the study to include fall or winter months may provide input for comparison to determine if seasons impact BP control.

Despite these limitations, the strength of the data collected is such that it revealed several important aspects of the antihypertensive drug utilization pattern and adherence of these drugs to JNC-VIII guidelines in different co-morbid conditions.

CONCLUSION

Present results reveals that antihypertensive medication adherence to JNC-8 recommendations is suboptimal. Therefore, physicians should follow JNC-8 guidelines to improve the patients care because suboptimal adherence leads to adverse clinical outcomes. In conclusion, present study demonstrated that physicians are not completely adhering to standard guidelines while treating hypertension with co-morbid conditions.

Despite evidence-based recommendations by JNC 8, provider adherence in AAs has room for improvement. Provider pharmacologic choices and lifestyle modification recommendations are major components to blood pressure control in this population. Thiazide diuretics are recommended as initial monotherapy and in combination therapy for Indian hypertensive patients. ACEIs, ARBs and CCBs are recommended as an acceptable alternative to thiazide diuretics. Prescribers have demonstrated a preference in prescribing ACEIs and ARBs in monotherapy. Adherence rates to JNC 8 were adequate in Stage 1, hypertensive emergency and urgency and inadequate in case of pre-HT and Stage 2 HT. BBs were under prescribed as this is not in the first line drug for initial management of hypertension. Polypharmacy, FDCs, debated rationality anti-HT combinations prescribing, were some of the common pharmacologically considered irrationality noticed in present study.

ACKNOWLEDGEMENT

ICMR STS-2018, Ref. ID: 2018-02040
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Source of Support: Nil; Conflict of Interest: None
Submitted: 02-09-2019; Accepted: 30-09-2019; Published: 28-10-2019