

Evaluate the current prescription practice in newly diagnosed hypertensive patients; Treatment comparison with ISH 2020 Guidelines

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Abstract—

Background: Hypertension is a very common medical problem worldwide. It is under-recognized and poorly treated. There is scope for significant improvement in hypertension therapy since only one-third of hypertension in India is diagnosed, of which only one-third is well treated and well controlled. **Objective:** The main objective of this study is to evaluate the current prescription practice of antihypertensive drugs in newly diagnosed hypertensive patients and to determine whether the prescription pattern is in adherence with ISH 2020 guidelines for the management of hypertension. **Method:** A prospective observational study was carried out for six months in a tertiary care hospital across the medical and cardiology services. **Result:** A total of 73 prescriptions were analyzed. Our results revealed that 54.80% were male while 45.20% were female, of which 49 (67.1%), 10 (13.7%), 6 (8.2%), 5 (6.8%) patients were receiving one, two, three and four anti-hypertensive drugs, respectively. Only 3 patients were on non-pharmacological treatment. In our study out of a total of 61 (83.56%) patients received essential standard care and 12 (16.43%) patients received optimal standard care, among which the majority, 64 (87.67%) patients achieved the targeted BP control and 9 (12.32%) didn't achieve the target BP. The most commonly prescribed anti-hypertensive drugs, whether in mono or combination regimens, were CCBs (amlodipine, cilnidipine), followed by ARBs (telmisartan, valsartan), diuretics (hydrochlorothiazide, torsemide, furosemide, mannitol), β -blockers (atenolol, bisoprolol, metoprolol), and ACE inhibitors (ramipril, enalapril). The mean systolic blood pressure Mean \pm SD of SBP/DBP in the final and first visit was 129.98 \pm 13.13/84.30 \pm 9.45 mmHg and 154.12 \pm 13.21/92.72 \pm 14.08 mmHg, respectively. A significant reduction ($p < 0.0001$) in both systolic and diastolic blood pressure was observed. **Conclusion:** The CCBs (Cilnidipine) and ARBs (Telmisartan) were the drugs of choice for hypertensive patients as a single drug and combination drug therapy. As per the International Society of Hypertension (ISH), 2020 guidelines, the majority of the subjects have achieved targeted BP goals. Our results reveal that prescription practice of anti-hypertensive medication and adherence to guidelines is optimal at the study site.

Key words— Newly diagnosed hypertension, prescription practice, antihypertensive, ISH.

I. INTRODUCTION

Worldwide, cardiovascular diseases account for most of the non-communicable disease deaths (17.9 million deaths annually) and one of the major risk factors for cardiovascular diseases is hypertension. Around 9.4 million deaths annually worldwide occur due to raised blood pressure [1]. Hypertension is one of the most widespread medical conditions in the world [2-4]. A recent analysis (1990-2019) showed that worldwide the prevalence of hypertension in the adult population has increased from 650 million to 1.28 billion in the last thirty years and nearly 50% of these people were unaware of they had hypertension [5]. As hypertension is increasing enormously each year, it is predicted to increase up to 1.56 billion by the year 2025 i.e., 20% in developed nations, and 80% in developing nations, resulting in economic burden (and nearly 67% of hypertensive patients come from low- and middle-income countries) [6]. According to studies, in 2017 it was estimated that about 35% of adults in India had hypertension, which is considered one of the main leading causes of death in India [7]. Therefore, awareness, prevention, treatment and control of raised blood pressure a prerequisite for reducing the prevalence and mortality of cardiovascular diseases and preventing uncontrolled consequences. It is well evident that combining non-pharmacological and appropriate antihypertensive treatment significantly improves the quality of life as well as lower the mortality and morbidity rate associated with hypertension [8].

Over the past years, across the globe, there have been several hypertension guidelines published which are designed to assist physicians in achieving proper hypertension control. Despite this, low- and middle-income countries struggled to treat hypertension effectively. Thus, the new 2020 ISH Global Hypertension Practice Guidelines were the first to be developed by the ISH Hypertension Guidelines Committee specifically for the management of hypertension based on evidence criteria. The ISH Guidelines, 2020 are intended to fit for application in low and high-income resources settings by recommendations into two categories: Essential (the minimal standard of care that should be provided), and Optimal (care that should be provided when resources allow) standard care [9].

The treatment strategy for newly diagnosed hypertension differ from one standard guideline to another, according to the JNC8 thiazide diuretic, ACE Inhibitor, or ARB, calcium-channel blocker, are considered the drug of choice [10], based on the European Society of Hypertension / European Society of Cardiology preferred either diuretics, ACE Inhibitor, or ARB, calcium-channel blocker, and beta-blockers [11], and as per ISH guidelines combination therapy are preferred over the mono-therapy as mono-therapy is used only the low-risk grade 1 HTN or in a patient with age ≥ 80 or frailer [9]. In general, all standard guidelines recommend that for the treatment of hypertension with or without compelling indication, combination therapy is more effective than the higher-dose

single-drug therapy because various studies show that combination therapy is therapeutically efficacious and the targeted blood pressure can be achieved under less period as compared to monotherapy [12-13].

Prescription pattern studies provide an overview of the current information about drugs' uses, quality of drugs, and the extent of the adherence to the gold standard guidelines [14]. These studies are essential to enhancing the appropriate use of medication to improve overall public health, because the irrationality in prescription accounts for medication errors causing increases in morbidity or hospitalization and economic loss. Several studies have been done to evaluate the prescribing pattern of anti-hypertensive drugs globally [15]. The prescription practice patterns used for treating hypertension differ from one another, in accordance with different physician knowledge and individual patients' needs [14,15]. From the past 20 years, there has been a gradual increase in the use of ACEIs, ARBs and CCBs and various clinical research reported that there is no consistent differences in anti-hypertensive efficacy, side effects and quality of life between these drug classes[16,17] However, based on the three different placebo- controlled studies i.e., Anti-hypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial (ALLHAT) [18], Losartan Intervention for Endpoint Reduction (LIFE) [19], and Valsartan Anti-hypertension Long-term Use Evaluation (VALUE) trial [20], showed that the low-dose thiazide diuretics are the first-line choice of drug for the treating uncomplicated hypertension as well as it decreases the risk of cardiovascular diseases more than other Anti-hypertensive drugs and in addition to that the VALUE trial, reported that in case of the amlodipine and the valsartan, both have the same therapeutic effectiveness.

In this present study, we studied the current prescription practice of antihypertensive drugs in newly diagnosed hypertensive patients in tertiary care hospitals, Bangalore. In addition, we evaluated whether the practice of prescription antihypertensive drugs used is appropriate and in accordance with standard ISH, 2020 guidelines for the management of raised BP.

II. MATERIALS AND METHODS

A prospective observational study was conducted across the medicine and cardiology departments of the Tertiary care hospital over six months from Jan 2021 to June 2021. The sample involved 73 prescriptions of newly diagnosed HTN, which were evaluated for assessing the current prescription practice. A patient who was diagnosed hypertensive recently at ≥ 18 years old and on antihypertensive therapy and/or non-pharmacological management were included in this study. The data collection was conducted by two methods: reviewing the patient medical record and the second interviewing the patient with a self-designed questionnaire to determine the practice of antihypertensive therapy, and adherence to the medication. The data obtained from the patient medical record and patient interviewing included the medical registration number (IP/OP number), patients' gender, age, weight, height, body mass index, date of diagnosis, the drug prescribed along with doses, frequency, duration and any changes made in medication during treatment, blood pressure before treatment (first visit), blood pressure after treatment (last visit), any comorbidities, lifestyle habits.

In this study, we used Morisky Medication Adherence Scale-8 to assess the medication adherence. The Morisky Medication Adherence Scale is validated assessment tool used to measure non-adherence in variety of patient population. MMAS-8 is an eight (questions) item's structure scale, self-report measure that assesses medication adherent to chronic medications and in addition it is low cost, simple to use. The questions are designed in such a way to avoid answering yes to the questions regardless of their content. Items 1 through 7 have response choices "yes" or "no" whereas item 8 has 5-point Likert response choices. Each "no" response is rated as "1" and each "yes" is rated as "0" except for item 5, in which each response "yes" is rated as "1" and each "no" is rated as "0". For item 8, if a patient chooses response "0", the score is "1" and if they choose response "4", the score is "0". Responses "1, 2, 3" are respectively rated as "0.25, 0.75, 0.75". Total MMAS-8 scores can range from 0 to 8 and have been categorized into three levels of adherence: high adherence (score = 8), medium adherence (score of 6 to < 8), and low adherence (score < 6) [21,22].

Statistical analysis was performed using MedCalc, the computer software. The results were reported as a mean \pm SD and p-value of < 0.005 was regarded as statistically significant.

III. RESULT

Demographic Data

The demographic data of the study patients are presented in table 1. A total of 73 prescriptions were analyzed. Our results revealed that 54.80% were male while 45.20% were female, of which 49 (67.1%), 10 (13.7%), 6 (8.2%), 5 (6.8%) patients were receiving one, two, three and four anti-hypertensive drugs, respectively. Only 3 patients were on non-pharmacological treatment. The male female ratio is 1.2:1.

Table 1: Gender, age groups and mean \pm SD of ages, weight, BMI of study newly diagnosed hypertensive patients (N=73).

Parameter	No. of Patients (%)		Mean \pm SD		Total
	Male	Female	Male	Female	
Gender	40 (54.80%)	33(45.20%)	-	-	73 (100%)
Age (In years)	-	-	52.24 \pm 17.10	56.24 \pm 13.68	-

Age Group					
Below 20	1(1.36%)	0(0%)	-	-	
20-40	7(9.58%)	7(9.58%)			
40-60	19(26.02%)	11(15.06%)			
Above 60	13(17.80%)	15(20.54%)			
Weight (kg)	-	-	71.83±9.38	73.40±19.51	72.54±14.86
BMI (kg/m ²)	-	-	25.90±3.04	28.4±6.92	27.05±5.27

Prescription pattern of antihypertensive drugs

Throughout the drug prescription pattern analysis, it was found that 3 patients (4.2%) were not receiving any drug regimen at the time of evaluation and they were kept on non-pharmacological treatment (i.e., lifestyle modifications, weight reduction, salt restriction, an appropriate degree of exercise...etc.), 49 patients (67.1%) was prescribed with mono-antihypertensive therapy, 10 patients (13.7%) received dual-antihypertensive therapy, 6 patients (8.4%) received triple anti-hypertensive therapy, and the remaining 5 patients (7%) were given quad-anti-hypertensive drugs.

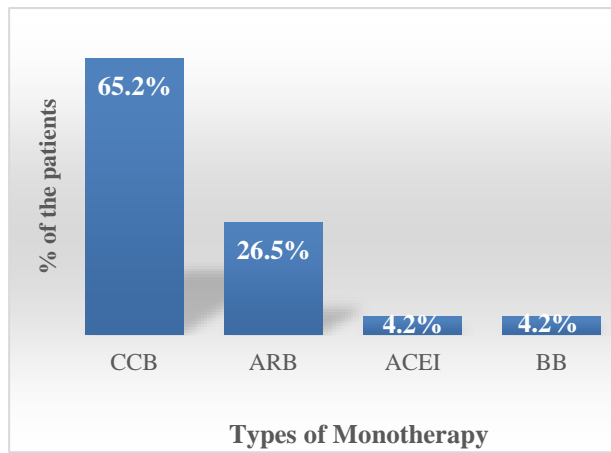
Monotherapy

For the patients who were on mono-antihypertensive drugs the data of different groups of antihypertensive drugs used are presented in Table 2. Forty-nine (70%) patients were receiving only one drug to control hypertension. The most frequently used drugs were CCBs (65.2% of patients) followed by ARBs (26.5% of patients), ACEIs (4.2% of patients), and BBs (4.2% of patients).

Table 2. Mono-antihypertensive drugs are prescribed to study patients

Class of drugs	Drugs	Number of patients	Patients with monotherapy (N=49)	Total study patients (N=73)
Calcium Channel Blockers (65.2%)	Amlodipine	13	26.5%	17.8%
	Cilnidipine	19	38.7%	26%
Angiotensin Receptor Blockers (26.5%)	Telmisartan	11	22.4%	15.1%
	Losartan	02	4.1%	2.7%
Angiotensin Converting Enzyme Inhibitors (4.2%)	Ramipril	01	2.1%	1.4%
	Enalapril	01	2.1%	1.4%
BBs (4.2%)	Metoprolol	02	4.1%	2.7%
Total		49	100%	67.1

Fig no. 1: Distribution of mono-antihypertensive drugs among newly diagnosed hypertensive patients.



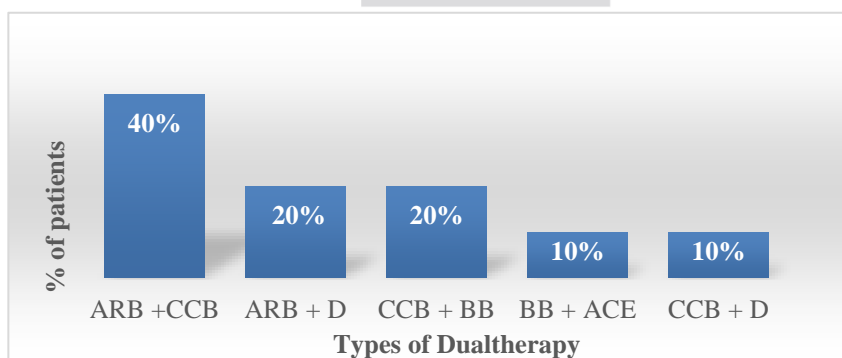
Dual Therapy

For the patients who were on two antihypertensive drugs the data of different groups of antihypertensive drugs used are presented in Table 3. Ten (13.7%) of patients were on two antihypertensive drugs (dual therapy). The most frequently used combinations were ARBs with CCBs i.e., Telmisartan + Cilnidipine and Telmisartan + Amlodipine (40% of patients) followed by diuretics with ARBs i.e., Telmisartan+ Hydrochlorothiazide (20% of patients) as well CCBs with a BBs i.e., Amlodipine + Metoprolol and Nifedipine + Atenolol (20%), CCBs with a diuretic i.e., Cilnidipine + Mannitol (10% of patients) and ACEIs with a BBs i.e., Ramipril+ Bisoprolol (10 patients).

Table 3: Dual-antihypertensive drugs prescribed to study patients.

Class of drugs	Drugs	No. of patients	Patients with Dual Therapy (N=10)	Total study patients (N=73)
ARB+CCB (40%)	Telmisartan +Cilnidipine	02	20%	2.7%
	Telmisartan +Amlodipine	02	20%	2.7%
ARB+D (20%)	Telmisartan +Hydrochlorothiazide	02	20%	2.7%
CCB+BB (20%)	Amlodipine +Metoprolol	01	10%	1.4%
	Nifedipine +Atenolol	01	10%	1.4%
BB+ACE (10%)	Bisoprolol + Ramipril	01	10%	1.4%
CCB+D (10%)	Cilnidipine +Mannitol	01	10%	1.4%
Total		10	100%	13.7%

Fig no. 2: Distribution of dual-antihypertensive drugs among newly diagnosed hypertensive patients.



Triple Therapy

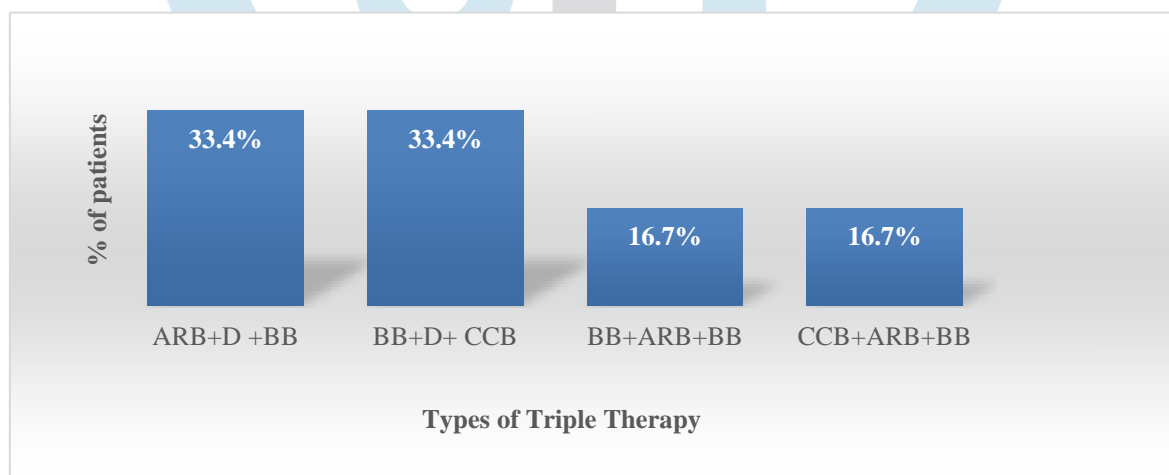
Six (8.4%) of the patients were on the three drugs, every 2 patients (33.4%) of whom were on CCBs with diuretics and BBs i.e., Metoprolol+ Furosemide + Cilnidipine and Atenolol +Spironolactone + Amlodipine; and ARBs with diuretics and a BBs i.e.,

Telmisartan + Spironolactone + Metoprolol and Telmisartan + Chlorthalidone+ Metoprolol and the rest of the triple therapy combinations are shown in Table 4. In the triple therapy, the BBs were found to be the most frequently used class of antihypertensive drugs (6 patients) in combination with other antihypertensive drugs.

Table 4: Triple-antihypertensive drugs prescribed to study patients.

Class of drugs	Drugs	No. of patients	Patients with triple-therapy (N=06)	Total patients study (N=73)
BB+D+ CCB (33.4%)	Metoprolol+Furosemide+Cilnidipine	01	16.7%	1.4%
	Atenolol+Spironolactone+Amlodipine	01	16.7%	1.4%
ARB+D +BB (33.4%)	Telmisartan+Spironolactone+Metaprolol	01	16.7%	1.4%
	Telmisartan+Chlorthalidone+Metoprolol	01	16.7%	1.4%
BB+ARB+BB (16.7%)	Metoprolol+Ramipril+Carvedilol	01	16.7%	1.4%
CCB+ARB+BB (16.7%)	Cilnidipine+Telmisartan+Bisoprolol	01	16.7%	1.4%
Total		06	100%	8.4%

Fig no. 3: Distribution of triple anti-hypertensive drugs among newly diagnosed hypertension.



Quad Therapy

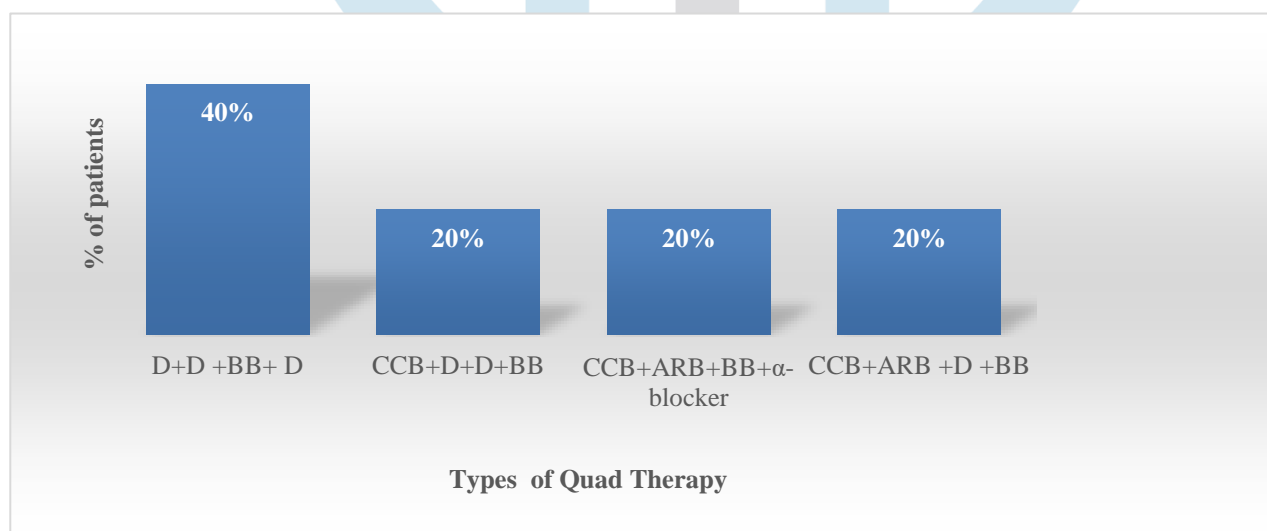
Of the patients who were on quad antihypertensive therapy, 05 (7%) patients, among them 2 patients (40%) of whom were on three diuretics with BBs i.e., Furosemide+Torsemide+Bisoprolol+Eplerenone and Torsemide+Eplerenone+Bisoprolol+Torsemide, followed by others antihypertensive drugs. The most frequently used combination included three diuretics with BBs and the rest of the quad therapy combinations are shown in Table 5.

The other combinational drugs used are as follows: CCBs with ARBs plus diuretics and beta-blockers i.e., Cilnidipine+Telmisartan+Hydrochlorothiazide+Bisoprolol, two diuretics with ARBs and BBs i.e., Cilnidipine+Furosemide+Spironolactone+Propranolol, and CCBs with ARBs plus BBs and alpha-blockers i.e., Cilnidipine+Telmisartan +Bisoprolol+Prazosin.

Table 5: Quad-antihypertensive drugs prescribed to study patients.

Class of drugs	Drugs	No. of patients	Patients with Quad-therapy (N=05)	Total study patients (N=73)
D+D+BB+D (40%)	Furosemide+Torsemide+ Bisoprolol+Eplerenone	01	20%	1.4%
	Torsemide+ Eplerenone+ Bisoprolol+Torsemide	01	20%	1.4%
CCB+ARB+D+BB (20%)	Cilnidipine+Telmisartan+ Hydrochlorothiazide+ Bisoprolol	01	20%	1.4%
CCB+D+D+BB (20%)	Cilnidipine+ Furosemide+ Spironolactone+ Propranolol	01	20%	1.4%
CCB+ARB+BB+ Alpha-blocker (20%)	Cilnidipine+Telmisartan +Bisoprolol+Prazosin	01	20%	1.4%
Total		05	100%	7%

Fig no. 4: Distribution of quad anti-hypertensive drugs among newly diagnosed hypertension.



Effectiveness of Therapy

Table 6 demonstrates the mean± SD (Standard Deviation) of systolic and diastolic blood pressure levels of the study patients in the first clinical and final clinical visits to Bangalore Baptist Hospital (BBH). On the first visit, the mean systolic blood pressure SBP± SD was 154.12±13.21 mm Hg, whereas the mean diastolic blood pressure (DBP)±SD was 92.72±14.08 mm Hg. In the last visit, SBP± SD was 129.98±13.13mm Hg, while DBP was 84.30±9.45mmHg. A significant reduction ($p < 0.0001$) in both systolic and diastolic blood pressures was observed in our patients on the last visit as compared to the first visit

Table 6: Mean±SD of systolic and diastolic blood pressures in the first and last visits to the BBH (N=73).

Parameter	First Visit (Mean±SD)		Final Visit (Mean±SD)		Mean Difference		P Value
	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)	SBP (mmHg)	DBP (mmHg)	
Non-pharmacological Therapy	136.66 ±4.71	91.66 ±2.35	123.33 ±4.71	86.66 ±4.71	13.33	5	<0.0001
Mono Therapy	153.16 ±11.54	93.95 ±10.32	129.28 ±13.60	84.77 ±9.84	23.88	9.18	<0.0001
Dual Therapy	160 ±14.14	98±4	132.6± 9.84	87± 6.40	27.4	11	<0.0001
Triple Therapy	160 ±5.77	90± 11.54	133.33 ±17.95	78.33± 10.67	26.67	11.67	<0.0001
Quad Therapy	157.2 ±20.18	94.4 ±14.60	131.6± 7.08	80± 6.32	25.6	14.4	<0.0001

Table 7 compares blood pressure levels in the first and last visits of our patients to the BBH according to the International Society of Hypertension (ISH, 2020), HTN classification Office BP measurement. These results express the effectiveness of control and management of hypertension in patients attending our hospital. On the first visit, around 80.6% of the study population had abnormal blood pressure readings (high-normal, Grade 1 HTN, Grade 2 HTN), among them 35.6% of them had severe blood pressure (Grade 2 HTN), 58.9% of patients had a Grade 1 HTN and 2.7% of patients had High-normal BP. On the last visit, around 36.3% of patients had abnormal blood pressure ranging from high-normal to Grade 2 HTN and about 50.6% of patients had normal BP as compared to patients on the first visit. Thus, better control of hypertension with antihypertensive therapy and lifestyle modifications was observed.

Table 7: Comparison between blood pressure in first versus last visit (N=73)

HTN (Classification)	No. of patients (%)		
	First Visit	Final Visit	Difference
Normal BP (<130/85mmHg)	2(2.7%)	37(50.6%)	+35
High-normal (130-139 /85-89mmHg)	2(2.7%)	24(32.8%)	+22
Grade 1 HTN (140-159/90-99mmHg)	43(58.9%)	11(15%)	-32
Grade 2 HTN (≥160/100mmHg)	26(35.6%)	1(1.36%)	-25

BP Control target as per ISH, 2020

According to ISH Guidelines, in 2020, out of 73 patients, 61 (83.56%) patients received essential standard care and 12 (16.43%) patients received optimal standard care are shown in Table 8. Among these, 64 (87.67%) patients achieved the ISH 2020 targeted BP control and 9 (12.32%) didn't achieve the target BP.

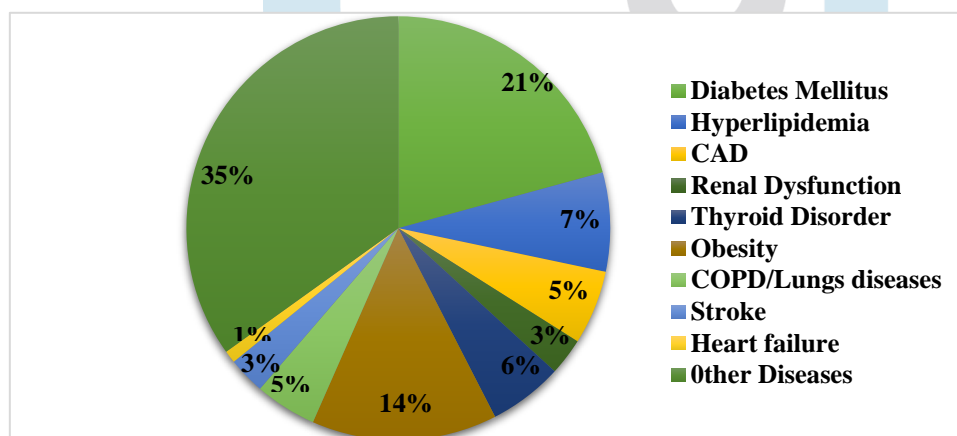
Table 8: BP control as per ISH 2020

Treatment target	Population	Goal BP within 3 months	No. of patients (%)	
			Achieved	Not achieved
Essential (N=61)	Whole hypertensive patients	≥ 20/10 mmHg	52(71.23%)	9(12.32%)
Optimal (N=12)	<65 years	<130/80 mmHg	2(2.73%)	-
	≥65 years	<140/90 mmHg	10(13.69%)	-

Comorbidities of Patients

Out of 73 patients, comorbidity was found in 47 (64.4%) subjects, the most common one being DM (46.8%) followed by Obesity (31.9%) and others shown in Figure 5. Out of com-morbid subjects, 22 (46.8%) were found to be diabetic with male and female diabetic percentages at 25.5% (12 males) and 21.3% (10 females) respectively. Out of com-morbid subjects, 15 (31.9%) were found to be obese, with male and female obesity percentages at 10.6% (5 males) and 21.3% (10 females) respectively. Other diseases, includes Chronic Liver Diseases, Tuberculosis, Urinary Tract Infections, Skin Disorder, Cancer, Gastrointestinal Disorders, Hypertensive retinopathy, Alzheimer's disease, Arthritis, Parkinson's disease, Atrial Fibrillation, and Angina.

Fig no.5: Comorbidities associated with newly diagnosed hypertension.



Assessment of Medication Adherence

Morisky Medication Adherence Scale-8 (MMAS-8) were used to assess the pattern of adherence for the antihypertensive drugs in newly diagnosed hypertensive patients in a clinical setting, in which the categorization of adherence is done into- adherent and non-adherent patients was based on the association between the scale and blood pressure control. In this, the patients who scored 8 (high adherence) were considered adherents, and patients who scored 6 to <8 (middle adherence) or <6 (low adherence) on the scale were considered non-adherents.

We selected 73 patients, three (3) of whom were not included in the study of medication adherence as they were on non-pharmacological treatment. The mean age of patients was 54.77 years (\pm 15.6), with a minimum age of 19 and a maximum of 82 years, and the majority (54.3%) of them were males, followed by females (45.7%). A higher rate of medication adherence towards their therapy was seen in female patients compared to male patients. In the female patients, 93.5% were compliant with their medication and only 6.5% were non-compliance in the case of male patients 81.4% were compliant with their medication and 18.6% of the patients were seen to be non-compliance with their medication/ therapy. Based on the monotherapy and combinational therapy, a higher rate of adherence is observed in the patient who was on the single drugs as compared to the multiple drugs therapy. Only 37 (52.9%) patients did some regular physical activity and the remaining 33 (47.1%) patients were not doing any physical activities. Smoking and alcohol consumption were reported by 18 (25.7%) and 8 (11.4%) of patients, respectively. In the majority of the patients in tertiary care hospital, 87.2% had achieved the targeted blood pressure. The following parameters/variables investigated were associated with adherence and non-adherence to the prescription are given in Table 9.

Table 9: Therapy Adherence, sociodemographic characteristics and life habits of hypertensive patients (N=70)

Parameters	Adherent		Non-adherent	
	<i>n</i>	%	<i>n</i>	%
Age				
Below 20	1	100	0	0
20-40	7	70	3	30
40-60	27	87.2	4	12.8
Above 60	26	92.9	2	7.1
Gender				
Male	31	81.4	7	18.6
Female	30	93.5	2	6.5
No. of antihypertensive drugs				
1	39	95.2	2	4.8
2	15	93.5	1	6.5
3	2	33.3	4	66.7
≥4	5	71.4	2	28.6
Leveling of school				
Primary or below	19	90.5	2	9.5
Secondary	10	83.3	2	16.7
Tertiary or above	32	86.5	5	13.5
Physical Activity				
Yes	35	94.6	2	5.4
No	26	78.8	7	21.2
Smoker				
Yes	14	77.8	4	22.2
No	47	90.4	5	9.6
Regular alcohol consumption				
Yes	3	37.5	5	62.5
No	58	93.5	4	6.9
Controlled BP				
Yes	61	100	0	0
No	2	22.2	7	77.8

The rate of therapeutic adherence in adherent patients (MMAS-8 = 8, high adherence) was 75.4%; among patients considered non-adherents, 21.3% had middle adherence, and 3.3% had low adherence, as shown in Table no. 10. According to analysis, patients who reached maximum values in the MMAS-8 were shown to be more likely to have blood pressure control than those who attained mean (6 to <8) or low (<6) values. The association of BP control is $p < 0.0001$ and mean SBP and DBP are $p < 0.0001$ with the degree of adherence.

Table 10: Association between the degree of therapy adherence with BP control and mean BP values.

Level of adherence (MMAS-8)	Blood Pressure control		Final mean BP values (in mmHg)	
	Yes (%)	No (%)	SBP±SD	DBP±SD
Low Adherence (<6)	2 (22.3%)	7(77.8%)	137±2	92.5±2.5
Middle Adherence (6-8)	13 (92.8%)	1 (7.2%)	134.53±5.34	86.53 ±5.95
High adherence (8)	46 (97.8%)	1 (2.2%)	123.27±10.31	82.53±8.64

IV. DISCUSSION

The results of our study suggest that out of the total 73 hypertensive patients included in the study, 40 patients (54.8%) were males while 33 patients (45.2%) were females, indicating the higher prevalence of hypertension in the male population as compared to the female population, i.e., 9.6% higher prevalence in males than in females. A similar observation was reported by Ashok Kumar Malpani et al. [21], Nimesh S. Narkar et al. [22], Ajay Kumar et al [23]. in India and Sang Hyuck Kim et al. [24] in South Korea. In contrast, a study conducted by H Tiwari et al. [25] in India, Biswash Sapkota et al. [26] in Nepal and E. Etuk et al. [27] in Nigeria reported a lower incidence of hypertension among the male population.

Our results showed that the highest number of male hypertensive patients was 19 (26.02%) belonged to the age group of 40-60 years and the highest number of female hypertensive patients was 15 (20.54%) belonged to the age group of above 60 years, suggesting the earlier onset of hypertension in males than in females. A similar study conducted by Krishna Murti et al. [28] showed that 35% of males belong to the age group of 40-60 years and 12.4% of females belong to the age group above 60 years. Whereas female hypertensive patients belonged to the age group of fewer than 20 years, 20 to 40 years, 40 -60 years and above 60 years were 0 (0%), 7(9.58%), 11(15.06%) and 15 (20.54%) respectively and male hypertensive patients belonged to the age group of fewer than 20 years, 20-40 years, 40-60 years and above 60 years were 1(1.36%), 7(9.58),19 (26.02%) and 13 (17.80%) respectively, which means that young females are significantly and substantially less likely to be hypertensive than males, but until after menopause in women when the prevalence of hypertension is higher in females compared to males of the same age group[29]

In the current study, we reported that the majority of patients (67.1%) received mono-therapy and their blood pressure at the end of the study was controlled, and is likely to be successful more frequently for Grade 1 hypertensive patients, although not fulfilling the ISH guidelines optimal standards care but meeting the ISH guidelines essential standards care, while other remaining of the patient's i.e. 29.1% were put on multi-drug therapy, out of which 13.7% of patients were on two drug therapy, 8.4% of patients on three drug therapy and 7% on four drug therapy[4]. Similar findings were reported by many researchers H. Tiwari et al.,[25] Kuchake VG et al.,[30] in India, and Sang Hyuk Kim et al. [24] in South Korea. The patient's drug compliance is seen to be more in mono-therapy, in addition to that it, is associated with lesser side effects and economical as well. Among the mono-therapy category, the various hypertensive classes prescribed were CCBs (65.2% of patients) followed by ARBs (26.5% of patients), ACEIs (4.2% of patients), and BBs (4.2% of patients). As a mono-therapy, Cilnidipine (38.7%) was the most frequently prescribed drug along with amlodipine (26.5%), telmisartan (22.4%), losartan (4.1%), ramipril (2.1%), enalapril (2.1%), and metoprolol (4.1%). In the overall utilization pattern of antihypertensive agents, CCBs (amlodipine, cilnidipine), followed by ARBs (telmisartan, valsartan), diuretics (hydrochlorothiazide, torsemide, furosemide, mannitol), β -blockers (atenolol, bisoprolol, metoprolol), and ACE inhibitors (ramipril, enalapril).

The most frequently prescribed 2-drug regimen was a combination therapy of CCBs with ARBs (40%), while the most frequently prescribed 3-drug regimen was found to be a combination therapy of CCBs with diuretics and BBs (33.4%) and ARBs with diuretics and a BBs (33.4%) and lastly, the most frequently prescribed 4 drug regimen was found to be a combination therapy of three diuretics with a BBs (40%).

According to the ISH guidelines for the management of arterial hypertension, combinational therapy is preferred over the mono-therapy as mono-therapy is used only the low-risk grade 1 HTN or inpatient with age \geq 80 or frailer but concerning the resources setting it recommended the two standard care i.e., essential standard care, in this mono-therapy or multiple drug therapy or free combination drugs which have clinical evidence benefits in relation to morbidity and mortality prevention as well as cost-efficiently, can be used. While in the case of optimal standard care, single-pill combination therapy is preferred in initial drug treatment followed by increasing doses and the addition of other antihypertensive drugs as per individual patient's needs. In our study, the majority of the patients were 61 (83.56%) received the essential standard care, among them, 52 (71.23%) achieved the treatment target while 9 (12.32%) patients did not achieve the targeted BP. It has been noted that patients who did not achieve the targeted BP were non-compliance to their medications and other remaining patients 12 (16.43%) received the optimal care, and on this whole, patients

achieved the targeted BP. Mono-therapy and combinational therapies were prescribed to the patients as per their clinical needs. CCBs have been found as most frequently prescribed class of antihypertensive as mono-therapy and combination too and the second highest prescribed antihypertensive drug group was ARBs in both mono-therapy and combination as well and followed by diuretics, BBs, and ACEIs. Similar studies conducted by Kuchake VG et. al.[30] Rachana PR et. al [31], in India, Onah Otor Paul et. al. [32] in Nigeria, and Pang-Hsiang Liu et. al. [33] in Taiwan reported that the CCBs are the most frequently used antihypertensive drugs, either alone or in combination which is followed by BBs, ACEIs, diuretics, other and in contrast CCBs were found to be least prescribed in a study conducted by Shapna Sultana et al. [34] in Bangladesh and Adela Alba- Leonel et. al. [35] in Mexico. Although among all of the mono-therapies, diuretics are considered a first-line drug according to international and national guidelines for antihypertensive treatment in addition to the least expensive antihypertensive drugs as compared to others antihypertensive drugs regardless of that diuretics are not prescribed in mono-therapy and to only 28% overall of our patients. While in contrast, Tom Walley et. al [14] studies conducted in the UK reported that diuretics are the first-line choice of drugs for antihypertensive treatment.

The majority of the studies and recent international guidelines recommended combination therapy over mono-therapy for better BP control and a rational approach to reducing cardiovascular mortality [9,10,11,12,13,36,37]. Hence, aggressive initial treatment for hypertension is recommended. Nowadays, in addition to that single-pill, the fixed-dose combination is preferred in concern to the patient's compliance with their medications. Despite that in our study, overall, the prescription rate of the combinational therapy was low throughout the study period, as compared to the other studies; we noted that our study patients were able to achieve the targeted BP with single or mono-therapy because of their good compliance towards their treatment therapy as they strictly followed the recommendation/instruction given by the physicians.

Out of the study subjects, 47 (64.4%) hypertensive patients were found to have other co-morbid conditions. Among the total, 64.4% of co-morbid patients, the most common were Diabetes mellitus (46.8%), followed by Obesity (31.9%), Hyperlipidemia (17%), CAD (12.7%), Thyroid Disorder (12.7%), lung diseases/ COPD (10.6%), Kidney Dysfunction (6.4%), Stroke (6.4%), Heart failure (2.2%) and others. A similar study conducted by Anand R. Kalamdani et al. [21] showed that out of 100 patients, comorbidities were found in 64 (64%) subjects, the most common one being Diabetes mellitus (75%), followed by COPD (14%) and others.

A significant ($p < 0.0001$) reduction of both mean systolic and diastolic BP was observed in all groups of our patients on the last visit as compared to the first visit, yet such reduction does fulfil the recommendations of the ISH, 2020 guidelines which stated clearly that the major goal for control of blood pressure is to achieve a level of systolic/diastolic blood pressure of $<140/<90$ mm Hg in the large majority of all hypertensive patients receiving drug treatment (guidelines). In our study, the means \pm SD of systolic blood pressure/diastolic blood pressure in the first and last visits was $154.12 \pm 13.21/92.72 \pm 14.08$ and $129.98 \pm 13.13/84.30 \pm 9.45$ mm Hg, respectively. However, in a similar study conducted by Essam Al-Drabah et al. [38] in the first visit, the means \pm SD of systolic blood pressure/diastolic blood pressure was $157.4 \pm 13.9/94.6 \pm 8.2$ mm Hg and on the last visit, the means \pm SD of systolic blood pressure/diastolic blood pressure was $133.4 \pm 18.4/83.2 \pm 10.1$ mm Hg.

Among hypertensive patients who have sub-optimal BP control, one of the major causes for that is non-compliance to their antihypertensive medications [39] In our study, self-reported medication adherence was measured by using the eight-item Morisky Medication Adherence Scale, in which the categorization of adherence in adherent and non-adherent patients was based on the association between the scale and blood pressure control. In this, the patients who scored 8 (high adherence) were considered adherents, and patients who scored 6 to <8 (middle adherence) or <6 (low adherence) on the scale were considered non-adherents. In our study, 75.4% of patients with high adherence and among patients considered non-adherents, 21.3% had middle adherence, and 3.3% had low adherence. However, in contrast to the study conducted by Alfredo Dias Oliveira-Filho et al., [40] 19.7% of patients have been reported with high adherence and among patients considered as non-adherents, 33.2% had middle adherence, and 47.1% had low adherence. Hence, the present study showed that the majority of the patients have a higher commitment to antihypertensive medications than non-adherence, unlike the other studies in which they reported that the majority of the patients have lower adherence to antihypertensive medications.

We believe that it is essential to evaluate the prescription pattern of antihypertensive medications in newly diagnosed hypertensive patients from time-to-time basis, which helped in improving patient's conditions and compliance with therapy. Therefore, helping patients with achieving or controlling BP and preventing complications associated with uncontrolled BP as well as in newly diagnosed hypertensive patients, the awareness program, regular screening, early diagnosis, and appropriate and rational prescribing practice in accordance with guidelines are recommended.

The data obtained from our study can be utilized in preventing problems related to medications, in evaluating the effectiveness of drug therapy and in making any changes in treatment regimen in patients if required.

V. CONCLUSIONS

Calcium channel blockers (Cilnidipine) and ARBs (Telmisartan) were the drugs of choice for hypertensive patients as a single drug and combination drug therapy in the in-patient and out-patient departments during the study period. In the current study, prospective and observational studies were carried out and evaluated in accordance with ISH, 2020 guidelines. We concluded that on the basis of our analysis of 73 prescription practices in newly diagnosed hypertensive patients, most subjects achieved the targeted BP control. The prescribing patterns of anti-hypertensive drugs optimally followed standard treatment as per ISH, 2020 guidelines for hypertension at the study site.

The anti-hypertensive medication prescribing pattern studies in newly diagnosed showed the current trend of prescription practice by a physician which helps in monitoring, evaluation and necessary modification (if needed) to be done in prescribing practice to promote the rational use of the drugs as well to achieve the targeted treatment goals, cost-effective treatment and improving the quality of life. Additionally, periodic updating of recommended standard guidelines, and prescription monitoring studies help in

rational utilization of anti-hypertensive drugs, accordingly as per the needs of individuals in high-income countries as well as in middle-and-low-income countries.

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