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Observational Study on Prescribing Patterns of Antihypertensive Agent and Evaluation of Comorbidities in Hypertensive Patients

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ABSTRACT

Appraise the prescribing patterns of anti hypertensive agents in the treatment of hypertension and related co-morbid conditions. To assess the prescribing patterns of medications in hypertensive patients. To study the demographics of patients associated with hypertension. To compare the differences in the prescribing patterns of antihypertensive drugs, with co morbidity conditions. Review on medication outcomes in hypertensive patients. To evaluate the rationality outcomes in hypertensive patients. To obtain the mean arterial blood pressure of an individual patient. The age group 40-69 has more affected females followed by males at age group 60-79. Blood pressure increases with age, presence of the co-morbid condition, body weight, and lifestyle modification. The cause of hypertension may be known in some individuals whereas in most of the patients the cause is unknown. The individuals must be made aware of hypertension and directions about management with drugs and non-pharmacological implementation. The presence of hypertension for years may lead to further complications which if managed and monitored regularly can reduce risk. During the study period, 92 individuals were stage 1 (36.8) hypertensive followed by stage 2 (29.6%), elevated (15.2%), and normal (9.6%). The most commonly prescribed drugs in the study were Telmisartan (22.8%), Amlodipine (2.8%), Furosemide (2.4), Nifedipine (1.4), Captopril (1.4%), Metoprolol (0.8%), and Torsemide (0.8%) followed by losartan, Olmesartan, propranolol, ramipril, terlipressin, atenolol, valsartan, carvedilol, mannitol, vasopressin, and bisoprolol. Based on JNC 8 guideline the rationality of drugs obtained was 74.8%.

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INTRODUCTION

Antihypertensive Hypertension is stated as "the persistently elevated arterial blood pressure (BP)". Blood pressure is quantified as systolic and diastolic pressure measured in mm Hg. The systolic blood pressure represents the pressure due to ventricular contraction during systole whereas, diastolic pressure represents the pressure of ventricular relaxation in diastole. Although elevated blood pressure is regarded as essential for adequate perfusion of essential organs during the early and middle 1900s, it is now considered as one of the most significant risk factors for cardiovascular diseases [1].

Outcome trials have shown that drug therapy significantly reduces the risk of cardiovascular events. The vital goal of treating hypertension is to decrease hypertension-associated morbidity and mortality. A goal BP of less than 140/90 mm Hg is suitable for general anticipation of cardiovascular events and cardiovascular deaths.

However, achieving Blood Pressure of less than 130/80 mm Hg goal is recommended in patients with co-morbid conditions like Diabetes, significant chronic kidney disease, known coronary artery disease (ischemic stroke, transient ischemic attack, peripheral artery disease, abdominal aortic aneurism), patients with left ventricular dysfunction (Systolic Heart Failure) must have a goal Blood Pressure of less than 120/80 mm Hg.

Hypertension is a major risk factor for stroke (both ischemic and hemorrhage), myocardial infarction, heart failure, chronic kidney disease, and peripheral vascular disease. Most individuals with hypertension don't suffer from any sign or symptom, the lesser individuals experience symptoms like headache, shortness of breath, epistaxis but these symptoms can't be specific for all the patients [2].

MATERIALS AND METHODS

Study Design

This is an observational study conducted over 6 months from October 2019 to March 2020 at Thumbay New Life Hospital, Chaderghat in an in-patient department.

The individuals who met the inclusion criteria are taken into consideration. The patients are included according to their interests and willingness to carry out the study [3].

Collection of Data

1. Patients demographics.
2. Prescription chart.
3. Nursing notes.
4. Medical records.
5. Doctors notes.

Inclusion Criteria

1. Patients above 20 years of age.
2. Blood pressure above 120/80.
3. Inpatients with case notes and laboratory investigations.
4. Patients with co-morbid conditions.

Exclusion Criteria

1. Pediatric department.
2. Patients below 20 years of age.
3. Pregnant and lactating women.

Methods and Collection of Data

The individuals are examined including their-

1. Chief complaints
2. History of present illness
3. Past disease history
4. Past medications
5. Complaints on any allergy to drugs
6. Interview with patient or caretakers
7. Patients prescription
8. Medical records of inpatients.

Etiology of Hypertension

In almost patients, hypertension results from an unknown pathophysiologic etiology which is known as Essential/Primary hypertension. This type of hypertension cannot be healed completely, but it can be managed.

A less percentage of patients have a specific cause of their hypertension which is known as Secondary hypertension. Besides, 90% of the people have essential hypertension [4].

Fewer than 10% of individuals have secondary hypertension either co-morbid diseases or drugs are responsible for increasing Blood Pressure. Some drugs directly or indirectly, can cause hypertension or exacerbate hypertension by increasing Blood Pressure.

CVD Risk Factors Common in Patients with Hypertension

The persistent presence of a particular co-morbid condition like kidney disorder, thyroid disease, Cushing's syndrome, etc results in worsening hypertension which leads to further complications like stroke, heart attack, aneurism, dementia, metabolic syndrome, etc [5].

Thus, proper management can reduce the risk and complications associated with hypertension [Table 1].

Table 1: Secondary Causes of Hypertension

Diseases	Drugs
• Chronic Kidney Disease • Cushing'S Syndrome • Obstructive Sle • Ep Apnea • Parathyroid Disease • Thyroid Disease • Congenitaladrenal Hyperplasia	• Adrenal Steroids • Amphetamines • Calcineurin Inhibitors • Decongestants • Oral Contraceptives • Nonsteroidal Inflammatory Drugs • Food Substances-Sodium, Ethanol

Table 2: Modifiable Risk Factor and Relatively Fixed Risk Factors

Modifiable Risk Factor	Relatively Fixed Risk Factors
• Current cigarette smoking, second-hand smoking • Diabetes Mellitus • Dyslipidemia/Hypercholesterolemia • Overweight/Obesity • Physical Inactivity	• Chronic Kidney Disease • Family History • Increased Age • Low Educational Status • Obstructive Sleep Apnea • Psychosocial Stress

Table 3: Prevalence of Hypertension based on SBP and DBP

	9SBP		DBP	
Age Groups	Men	Women	Men	Women
20-44	30%	19%	11%	10%
45-54	50%	44%	33%	27%
55-64	70%	63%	53%	52%
65-74	77%	75%	64%	63%
75+	79%	85%	71%	78%

Cardiovascular Disease Risk Factors

Observational studies have stated that cardiovascular disease risk factors frequently occur in combination [6], with more than 3 risk factors present in 17% of patients [Table 2].

Prevalence of Hypertension

The prevalence of hypertension based on age groups and respective Blood Pressure [7] values includes in Table 3.

Pharmacological Management

Generally, the goal of treating hypertension is to manage hypertension-related morbidity and mortality [8]. Managing risk remains the vital objective of hypertension therapy and the standard choice of drug therapy to be made for every particular comorbid condition to reduce the risk. During the treatment, the goal BP of less than 120/90 mm Hg is considered for the general prevention of cardiovascular events and cardiovascular disease [Table 4]. For individuals with hypertension, attaining the SBP goal almost assures achievement of the DBP goal. When coupled with the fact that SBP is a better predictor of cardiovascular risk than DBP, SBP can be used as the primary clinical marker control in individuals with hypertension.

However, lifestyle modification cannot be only considered, for patients with hypertension and additional cardiovascular risk factors [9]. The management with drug therapy depends on the blood pressure values and also occurs of any other disorder [Table 5].

The management of comorbid conditions is initiated through the following Joint National Committee Guidelines 8 which specifically provides the management of hypertension with comorbid diseases [Table 6].

The non-pharmacological interventions such as weight loss for obese patients, healthy diet which includes "Dash Diet", reducing sodium intake, enhancing potassium intake, regular physical activity practice, and limiting alcohol consumption reduces the risk for cardiovascular morbidity and mortality [10].

Table 4: Non-Pharmacological Interventions for Prevention and Treatment of Hypertension

	Non-pharmacological interventions	Dose	Appropriate Impact on Htn	Systolic Blood Pressure Normotension
Weight Loss	Weight/Body Fat	-	-5 mm Hg	-2/3 mm Hg
Healthy Diet	Dash Dietary Pattern	Diet Rich In Fruit, Vegetables, Whole Grain, And Low-Fatdairy Products	-11 mmHg	-3mm Hg
Reduce Intake of Dietary Sodium	Dietary Sodium	<1500 mg/d	-5/6 mm Hg	-2/3 mm Hg
Enhance Intake of Dietary Potassium	Dietary Potassium	3500-5000 mg/d	-4/5 mm Hg	-2 mm Hg
Physical Activity	Aerobic	90-150 min/week	-5/8 mm Hg	-2/4 mm Hg
	Dynamic Resistance	90-150 min/week	-4 mm Hg	-2 mm Hg
Moderate in Alcohol Intake	Alcohol Consumption	Men-<2 drinks/d Women-<1 drink/d	-4mm Hg	-3 mm Hg

Table 5: Blood Pressure Threshold for Goals of Pharmacologic Therapy in Patient'S with Hypertension According to Clinical Conditions

Clinical Condition'S	Bp Threshold Mm Hg	Bp Goal Mm Hg
Clinical CVD/ 10year ASCVD risk >10%	>130/80	<130/80
No clinical CVD	>140/90	<130/80
Older Person (>65years of age)	>130(SBP)	<130(SBP)

Table 6: Specific Comorbidities

Disorders	Bp Threshold Mm Hg	Bp Goal Mm Hg
Diabetes Mellitus	>130/80	<130/80
Chronic Kidney Disease	>130/80	<130/80
CKD Post Renal Transplant	>130/80	<130/80
Heart Failure	>130/80	<130/80
Stable Ischemic Heart Disease	>130/80	<130/80
Secondary Stroke Prevention	>140/90	<130/80
Peripheral Arterial Disease	>130/80	<130/80

Common Co-Morbid Conditions with Hypertension Diabetes

The contribution of hypertension in raising the microvascular and macrovascular risk in individuals with Diabetes has been confirmed in the United Kingdom Prospective Diabetes Study (UKPDS) and Hypertension Optimization Treatment trials. The recommendation for the management of blood pressure in patients with diabetes is less than130/80 mm Hg. The category of drugs included is ACE and ARB which are considered during the initial therapy management [11]. The national kidney foundation also recommends that the goal of blood pressure be considered is less than 130/80 mm Hg, as well as recommending diuretics as second-line drugs in individuals with diabetic kidney disease. Frequent monitoring of blood pressure is essential for patients with diabetes to reduce further risk and complications.

Heart Failure

Approximately two-thirds of heart failure patients have current hypertension or a history of hypertension. Hypertension can directly contribute to the development of heart failure or the presence of coronary artery disease contributes indirectly to heart failure [12]. The management of heart failure along with hypertension includes ACE inhibitors, Beta-blockers, and Diuretics, if the proper recovery is not achieved then additional drugs are included such as ARB, aldosterone antagonist, or a second-generation CCB such as amlodipine.

Diastolic Heart Failure

Hypertension complications can lead to diastolic heart failure. The individuals with heart failure and preserved ejection fraction have a history of hypertension with years which may worsen and lead to diastolic heart failure [13].

Peripheral Artery Disease

Hypertension is a risk factor for individuals with peripheral artery disease and can lead to further complications like acute myocardial infarction, stroke, and heart failure. The goal blood pressure in individuals with PAD is 130/80to prevent further complications [14].

Chronic Kidney Disease

The individual with hypertension is also affected by CKD, the abnormal filtration rate affects the blood pressure, and hence directly or indirectly it raises blood pressure. The proper management of hypertension in patients with CKD can reduce further risk. A goal BP of 130/80 is considered for CKD patients and management includes ACE inhibitors and ARB blockers [15].

RESULTS AND DISCUSSION

Hypertension is persistently elevated arterial blood pressure. The epidemiological data shows that 31% of the population has hypertension and among males and females, females are more prevalent according to our study [Table 7 & Figure 1]. The prevalence of females is higher due to improper therapy, lack of awareness, an unhealthy lifestyle. The age group 40-69 has more affected females followed by males at age group 60-79. Blood pressure increases with age, presence of the co-morbid condition, body weight, and lifestyle modification [Table 8 & Figure 2]. The cause of hypertension may be known in some individuals whereas in most of the patients the cause is unknown. During the study period, 92 individuals were stage 1(36.8) hypertensive followed by stage 2(29.6%), elevated (15.2%), and normal (9.6%).

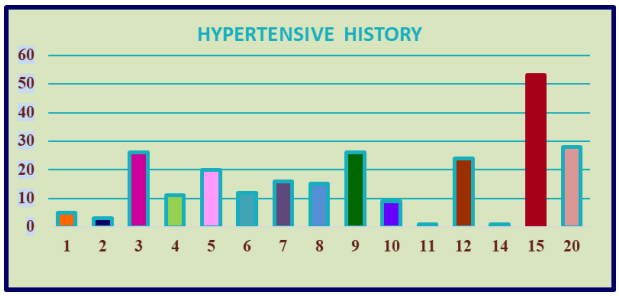

Figure 1: Hypertensive History of Patient's

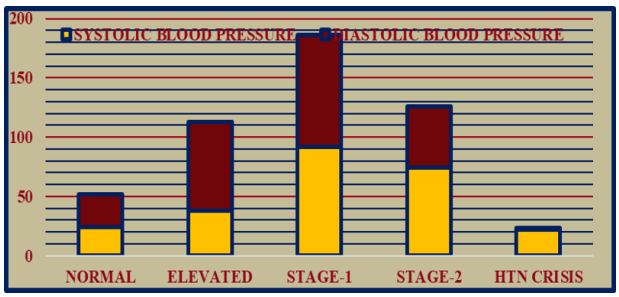

Figure 2: Stages of Blood Pressure – Systolic and Diastolic Blood Pressure

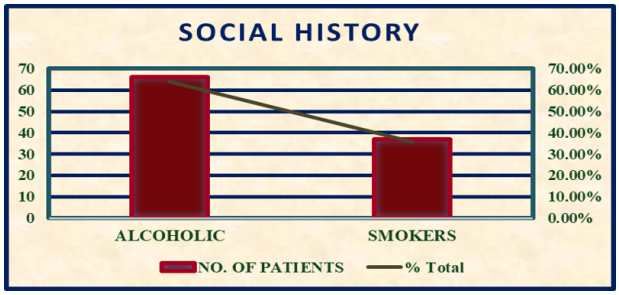

Figure 3: Social History of Hypertensive Drugs

The individuals must be made aware of hypertension and directions about management with

Table 7: Categorization Based on Age and Gender

Count of Age	Number of Males	Number of Females
20-29	1	2
30-39	8	9
40-49	19	22
50-59	17	32
60-69	35	40
70-79	25	18
80-89	11	10
90-99	0	1

Table 8: Stages of Blood Pressure – Systolic and Diastolic blood pressure

Stages of Blood Pressure	Systolic Blood Pressure	Diastolic Blood Pressure
Normal	24	28
Elevated	38	75
Stage-1	92	94
Stage-2	74	52
Hypertension Crisis	22	1

Table 9: Antihypertensive Drugs Category

Antihypertensive Drugs Category	Number of Patient'S	Percentage
ARB'S	71	28.4%
Diuretic's	11	4.4%
BB'S	8	3.2%
CCB'S	6	2.4%
ACE'S	4	1.6%

Table 10: Total Social History of Hypertensive Patients

Social history	Number of patients	Percentage
Alcoholic	66	26.4%
Smokers	37	14%

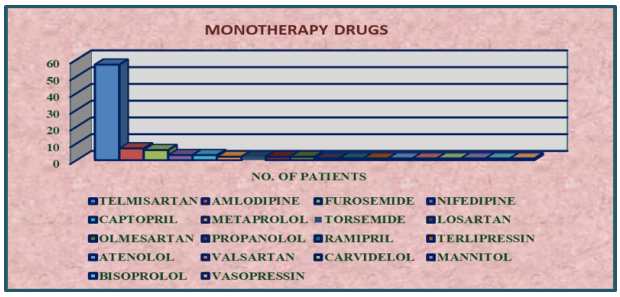

Figure 4: List of Monotherapy of Drugs

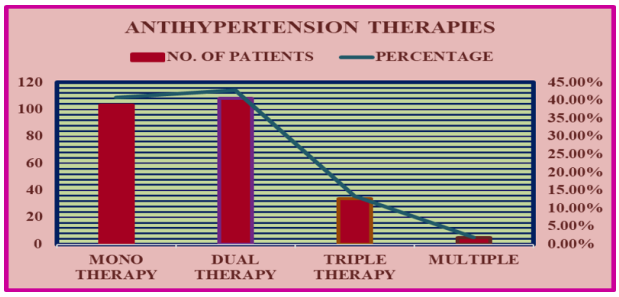

Figure 5: Antihypertensive Therapies

drugs and non-pharmacological implementation. The presence of hypertension for years may lead to further complications which if managed and monitored regularly can reduce risk. The elderly patients >65years of age are diagnosed as hypertensive according to JNC 8 guidelines due to multiple pathologies leading to polypharmacy, consumption of over-the-counter medications.

The choice of anti-hypertensive used for the management was ARB followed by diuretics, beta-

Table 11: Antihypertensive Dual Therapy Category

Antihypertension Dual Therapy	Number of Patient'S	Percentage
CCB'S+ARB'S	22	8.8%
ARB'S+BB'S	20	8%
Diuretic+ARB'S	17	6.8%
CCB'S+BB'S	16	6.4%
ACEI'S+ARB'S	16	6.4%
Diuretic+Diuretic	3	1.2%
BB'S+BB'S	3	1.2%
Diuretic+CCB'S	2	0.8%
Diuretic+ACEI'S	2	0.8%
ACEI'S+BB'S	2	0.8%
Nitrates+ACEI'S	1	0.4%
Diuretic+Alpha Bocker	1	0.4%
CCB'S+ACEI'S	1	0.4%
CCB'S+CCB'S	1	0.4%

Table 12: Antihypertensive Triple Therapy Category

Antihypertensive triple therapy category	Number of Patient's	Percentage
CCB'+BB'S+ARB'S	20	8%
ARB'S+CCB'S+Diuretics	3	1.2%
ARB'S+Diuretics+Nitrates	3	1.2%
Diuretic+ARB'S+BB'S	2	0.8%
Alpha Bocker+ACI'S+Diuretic	2	0.8%
BB'S+NITRATES+Diuretics	1	0.4%
Diuretics+BB'S+ACEI'S	1	0.4%
CCB'ALPHA BLOCKER+ARB'S	1	0.4%
Diuretic+CCB'S+Alpha Bocker	1	0.4%
Alpha Bocker+ARB'S+Diuretics	1	0.4%

Table 13: Statistical Data on Blood Pressure

Stages	SBP	DBP	ΣD	ΣD2
Normal	24	28	4	16
Elevated	38	75	37	1369
Stage-1	92	94	2	4
Stage-2	74	52	22	484
Htn Crisis	22	1	21	441
			ΣD=86	ΣD2=2314

Table 14: Statistical Test on Therapies

Age group	Mono therapy	Dual therapy	Triple therapy	Row total
20-29	2	1	0	3
30-39	6	12	1	19
40-49	13	25	3	41
50-59	16	28	5	49
60-69	21	46	7	74
70-79	10	23	10	43
80-89	2	14	4	20
90-99	0	1	0	1
Column Total (ΣX)	ΣX1=70	ΣX2=150	ΣX3=30	ΣX=250

Table 15: List Out Sources of Variance

Source of variance	Degree of freedom	Sum of squares	Mean squares	F
Between varities (column)	c-1=8-1=7	B-D =3537.5-2604.1 =933.4	MSC=B-D/c-1 =933.4/8-1 =933.4/7 =33.3	MSC/MSE =33.3/261.6 =0.12
Between treatments (rows)	r-1=3-2=1	C-D =4059.1-2604.1 =1455	MSE=C-D/r-1 =1455/2 =727.5	MSE/residual =727.5/261.6 =2.78
Residuals	(c-1)(r-1) =7x2 =14	[A-D-(B-D)+(C-D)] =5746-2604.1- [933.4]+[1455] =5746- 2604.1+521.6 =3141.9+521.6 =366.5	[A-D-(B-D)+(C D)]/(c-1)(r-1) =3663.5/14 =261.6	
Total	Cr-1 =24-1 =23	A-D =5746-2601.1 =3141.9		

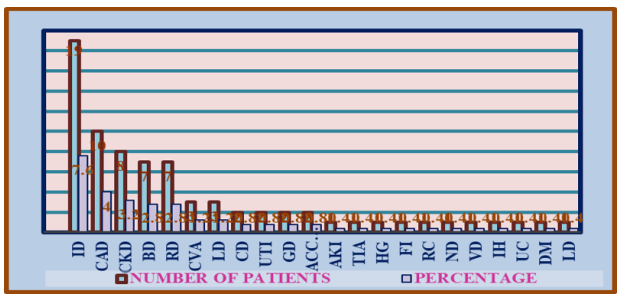

Figure 6: Single Co-Morbidity

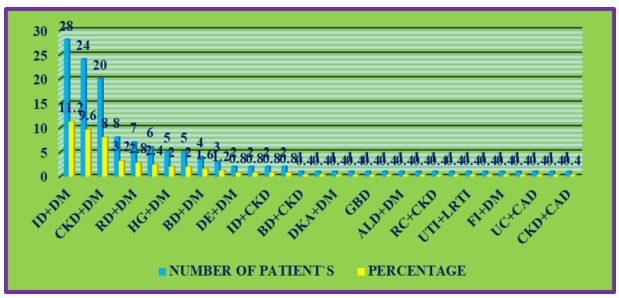

Figure 7: Dual Co-Morbidities

blockers, calcium channel blockers, and ARB'S.

Blood Pressure Categorization

The individuals must be made aware of hypertension and directions about management with drugs and non-pharmacological implementation. The presence of hypertension for years may lead to further complications which if managed and monitored regularly can reduce risk. The elderly patients >65years of age are diagnosed as hypertensive according to JNC 8 guidelines due to multiple pathologies leading to polypharmacy, consumption of over-the-counter medications.

The choice of anti-hypertensive used for the man-

agement was ARB followed by diuretics, beta-blockers, calcium channel blockers, and ARB'S.

Antihypertensive Drugs Category

The individuals must be made aware of hypertension and directions about management with drugs and non-pharmacological implementation. The presence of hypertension for years may lead to further complications which if managed and monitored regularly can reduce risk [Table 9]. The elderly patients >65years of age are diagnosed as hypertensive according to JNC 8 guidelines due to multiple pathologies leading to polypharmacy, consumption of over-the-counter medications [Table 10 & Figure 3]. The choice of anti-hypertensive used for the management was ARB followed by diuretics, beta-blockers, calcium channel blockers, and ARB'S.

Antihypertensive Monotherapy

The risk of co-morbid conditions is enhanced due to social habits, improper lifestyle, irregular drug management, and loss of physical activity. The co-morbid conditions observed were CVA, CAD, CKD, DM, AKI, PAD, etc which were managed with combinational drug therapy with two or more drugs [Figure 4]. The preferred fixed two-drug combination was CCB+ARB and ARB+BB, followed by triple-drug combination CCB+BB+ARB, and this practice positively impacted the overall blood pressure control. The prevalence of two co-morbid conditions was higher with the presence of hypertension with diabetes, CAD, CKD, CVA followed by rare conditions with orthopedic, gastroenterology, neurology, and pulmonologist disorder.

Antihypertensive Triple Therapy Category

The most commonly prescribed drugs in the study were Telmisartan (22.8%), Amlodipine (2.8%), Furosemide (2.4), Nifedipine (1.4), Captopril (1.4%), Metoprolol (0.8%), and Torsemide (0.8%) followed by losartan, Olmesartan, propranolol, ramipril, terlipressin, atenolol, valsartan, carvedilol, mannitol, vasopressin, and bisoprolol [Table 11, Table 12 and Figure 5]. Based on JNC 8 guideline the rationality of drugs obtained was 74.8%. Single CO-Morbidity [Figure 6]. Dual Co-Morbidities [Figure 7], Statistical Data on Blood Pressure [Table 13], Statistical Test on Therapies [Table 14], List out Sources of Variance [Table 15].

Hence t calculated value is greater than the t critical value and the P-value is less than, the difference between the two means is significant. The null hypothesis is rejected.

CONCLUSION

Our study which includes 300 samples provides the prevalence of hypertension higher in women. The most common choice of therapy followed was monotherapy involving Telmisartan (22.8%0). The management of hypertension was followed by monotherapy, dual therapy, and multiple therapies. The individuals with single co-morbidity were managed with monotherapy and the patients with two or more disorders are followed with a dual triple and multiple therapies. However, blood pressure control was obtained in some individuals, and in some blood pressure was still elevated after drug management due to the presence of co-morbid conditions and poor lifestyle modifications.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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