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"A STUDY ON DRUG UTILIZATION PATTERN OF ANTI-HYPERTENSIVE DRUGS IN TERTIARY HEALTH CARE TEACHING HOSPITAL DURING COVID-19 PANDEMIC"

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ABSTRACT

Hypertension is one of the most common cardiovascular diseases which are estimated to be responsible for 1.5 million deaths in India annually. It is the most prevalent modifiable cardiovascular risk factor for CHD, cerebro-vascular diseases and peripheral arterial diseases. This study was fabricated to evaluate the drug utilization pattern of antihypertensive drug in a tertiary care teaching hospital during the period of COVID-19 pandemic. DUE studies is an ongoing, authorized and systematic quality improvement process. A prospective observational study was conducted in a total of 100 patients at Srinivas Institute of Medical Science and research centre, Mangalore, for a period of six months. Case records diagnosed with hypertension were collected; the demographic information and prescription pattern were evaluated. The data collected were analysed using Microsoft Excel Software. Out of 100 patients 59% were male and 41% were female. Maximum patients belonged to the age group of more than 65 years (54%). A total of 152 drugs were prescribed during the study out of which the most frequent antihypertensive class to be prescribed (22.4%) were ARBs (22.4%) significantly higher than CCBs (21.8%) and diuretics (18.4%). Fixed dose combination of two diuretics (44.44%) is prescribed higher than the combination of ARBs with diuretics (18.18%) and CCBs with beta blockers (18.18%). In this study most of the patients had received two antihypertensive drugs (40%), 39% of patient received one drug therapy while 14% received three antihypertensive drugs and 7% received four drugs for the treatment of Hypertension. Diabetes mellitus was the most commonly associated disease with hypertension being diagnosed among 62 patients in total. The present study suggested that hospital is abiding to the guidelines of seventh

report of JNC and the research finding provided an insight into antihypertensive drug utilization pattern in tertiary care hospital and their rational use. Further studies on drug utilization pattern from time to time and the circulation of standard guidelines among prescribing physicians for the treatment of hypertension are required for the rational utilization of drugs in order to achieve maximal therapeutic efficacy.

KEYWORDS: Hypertension, Drug Utilization study, prescribing pattern, antihypertensive agent.

CHAPTER 1: INTRODUCTION

Hypertension is one of the most common cardiovascular diseases which is estimated to be responsible for 1.5 million deaths in India annually and is a leading risk factor for coronary artery disease, stroke and chronic renal disease. HTN increases with age, with its prevalence increasing from 27% in the patients aged younger than 60 years to 74% in those aged older than 8 years.[1]

Evidence from large clinical trials suggests that lowering BP with antihypertensive agents can improve the quality of life and decrease the attributed morbidity and mortality in hypertensive patients.[2] Antihypertensive drug therapy has improved noticeably in previous years, but different complications has aroused due to raise in the number of drugs for the treatment of hypertension. To counteract the problem, the Joint National Committee (JNC) designed a guideline for the treatment of Hypertension and provides with the updated recommendations to manage the arising health challenges among hypertensive patients.[3] Changes over time in terms of recommended guidelines and innovations in drug formulations have resulted in modifications in prescription pattern of antihypertensive drugs in various countries.[4]

Drug utilization or DUE studies are ongoing, authorized and systematic quality improvement process which are designed to review drug use and prescribing pattern for certain disease in comparison with current recommendations or guidelines, provide feedback of results to clinicians and promote appropriate drug use through education and other intervention.[5]

Drug utilization study on current prescribing trends of antihypertensive agents in the hospitals could be evaluated for appropriateness by comparing with standard guidelines, which may help in rational utilization of the drug based on patient conditions and co-morbidities. The

study on drug utilization involves data collection and evaluation on patient demographics, clinical evidence and treatment approaches. Medical and economic consequences of drug therapy can be evaluated and analyzed by performing Drug utilization studies as they observe the drug prescribing attitude of the clinician to use the medicines rationally.[6]

The increased concern towards the management of hypertension due to the covid-19, has not resulted in any change of treatment pattern of antihypertensive agents despite of the theoretic speculations of certain antihypertensive class being contraindicated.

The sudden emergence of COVID-19 has increased the concern towards the management of hypertension based on the initial hypothesis of positive relationship with certain antihypertensive drugs and the speculation of increasing the patient's risk for acquiring the infection and resulting in severe complications with drugs such as ARBs and ACE inhibitors.[7] The present study reviews the drug utilization evaluation conducted during the period before the COVID-19 pandemic and compared with the results obtained from the current study to check the possible changes in the prescribing pattern of ARBs and ACEIs.

The study was aimed at identifying the patient demographic details, associated co-morbid conditions, evaluating the different classes of antihypertensive medications that are prescribed with respect to diagnosis and to carry out the drug utilization review on anti-hypertensive drugs with its possible combinations in tertiary care teaching hospital.

CHAPTER 2: AIMS AND OBJECTIVES

GENERAL OBJECTIVE

- To study drug utilization pattern among hypertensive patients in a tertiary care teaching hospital during the period of COVID-19 pandemic.

SPECIFIC OBJECTIVES

- To observe the demographic pattern of hypertensive patients.
- To identify drug prescribing pattern of antihypertensive drugs.
- To compare the prescribing pattern of antihypertensive drugs with JNC VII guideline.
- To observe the effect of concurrent disease on hypertensive treatment

CHAPTER 3: METHODOLOGY

3.1 METHODOLOGY AND OPERATIONAL MODALITY

3.1.1. Study Site

A prospective observational study was carried out at Srinivas Institute of Medical Science and Research Centre, Mukka-574146, a multi-specialty tertiary care teaching hospital in Mangaluru from October 2020 to March 2021.

3.1.2. Study Design

Prospective Observational study.

3.1.3. Study Duration

The study was conducted for a duration of 6 months from October 2020 to March 2021.

3.1.4. Ethical Clearance

The study protocol was approved by Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science and Research Centre, Mukka-574146.

3.1.5. Study Criteria

Inclusion criteria

- Patients above 18 years of age.
- Patients admitted to the hospital during the period of Covid-19 pandemic.
- Patients diagnosed with hypertension along with other co-morbidities.
- Patients who are prescribed with anti-hypertensive drugs.

Exclusion criteria

- Patients below 18 years of age.
- Out patients.
- Patients with gestational hypertension.

3.1.6. Source of data

The data collected for study was taken from the case files of patients admitted in the general medicine department of Srinivas Institute of Medical Science and Research Centre, and it included patient demographic details, medical & medication history, daily investigation details and treatment pattern.

3.1.7. Sample size

Based on the inclusion and exclusion criteria, case files of patients admitted to the General medicine department were obtained. A total of 100 hypertensive patients along with other co-morbidities met the selection criteria.

3.1.8. Study method

A structured data collection form was used to collect the data from case files of In-patients. The data was collected from the case files of In-patients which were filled by doctors, nurses, pharmacist and other health-care professionals. Data collected includes patient demographic details, medical and medication history, daily investigation chart, treatment pattern and all the details were kept confidential.

3.1.9. Data analysis

The collected data were analyzed by using Microsoft Excel 2016. The drug utilization pattern of anti-hypertensive drugs and rationality of the drug use was analyzed using JNC-7 guidelines. It has been observed and concluded on the basis of case files of hypertensive patients along with other co-morbidities. Data analysis involved collecting and scrutinizing every data sample in a set of items from which samples can be drawn and analyzed.

CHAPTER 5: RESULTS

5.1 DEMOGRAPHIC PROFILE OF THE STUDY PARTICIPANTS

A total of 100 case data files were assessed during the entire study period, out of which 59 (59%) were male and 41 (41%) were female respectively. From the data which has been collected, maximum patients belonged to age group of more than 65 years (54%), in which 33 were male and 21 were female, 43% of the patients belonged to the age group of 41-65 years, among which 24 were male and 19 were female and 3% of the study subjects were less than 40 years, out of which 2 were male and one was female. Mean age in study subject was found to be 65.84 years.

Table 1: Number of patients with hypertension based on their age.

Age	Number of patients		Total numbers	%
	Male	Female		
<40	2	1	3	3%
41-65	24	19	43	43%
> 65	33	21	54	54%

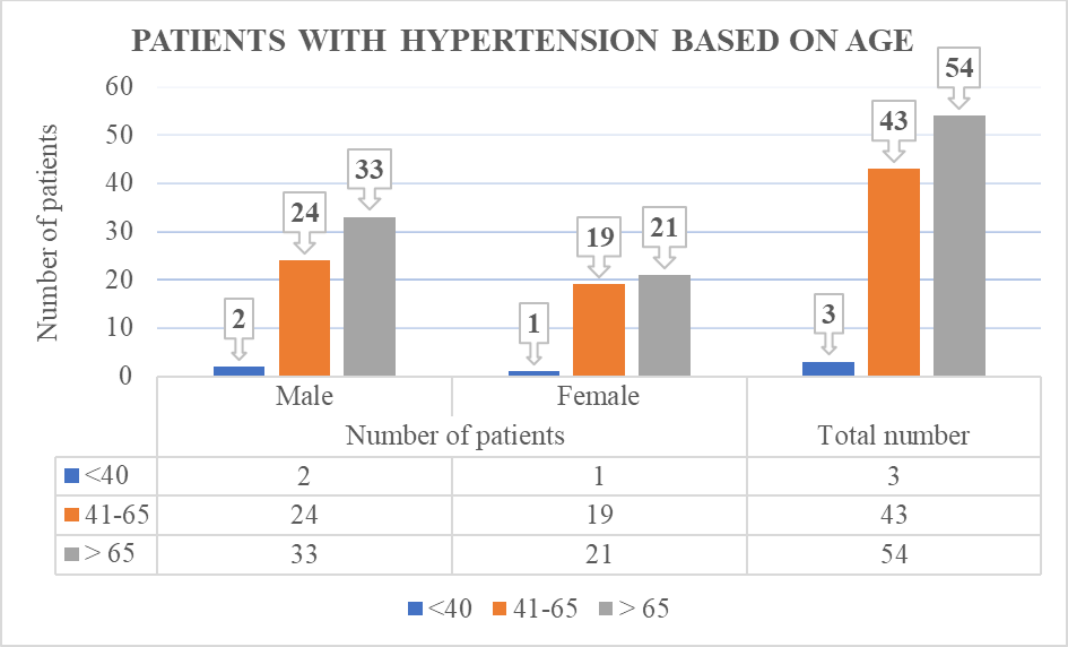

Figure 1: Number of patients with hypertension based on their age.

5.2 PRESCRIBING PATTERN OF ANTIHYPERTENSIVE DRUGS

A total of 152 drugs were prescribed during the study in which telmisartan (ARBs) was the most prescribed antihypertensive drug (16.8%), furosemide (15.12%) and amlodipine (13.4%). As a class, ARBs were prescribed the most (22.4%), CCBs (21.8%) and diuretics (18.4%). Considering the total number of antihypertensive drug prescribed as monotherapy, ARBs exceeds the drug share, comprising of 68.9% telmisartan, 24.13% losartan and 1.68% olmesartan. ARBs are followed by CCBs, comprising of 61.9% amlodipine, 19.2% cilnidipine and nicardipine. The Diuretics comprised of 81.8% furosemide given as monotherapy and 18.18% torsemide. ACEIs are comprised of 50% each enalapril and ramipril and the adrenergic blockers were comprised 31.57%atenolol and metoprolol each, 26.31% clonidine, and 10.5% propranolol.

Table 2: Prescribing pattern of antihypertensive drugs.

Antihypertensive class	Drug name	No. of drugs (n=119)	Percentage
ACEIs Total=10(8.4%)	Enalapril	5	4.20%
	Ramipril	5	4.20%
ARBs Total=29(22.4%)	Telmisartan	20	16.8%
	Losartan	7	5.88%
	Olmesartan	2	1.68%
Beta blockers Total=14(11.7%)	Atenolol	6	5.04%
	Metoprolol	6	5.04%
	Propranolol	2	1.68%

	Bisoprolol	3	2.52%
CCBs Total=26(21.8%)	Amlodipine	16	13.44%
	Cilnidipine	5	4.20%
	Nicardipine	5	4.20%
Alpha blockers Total=5(5.4%)	Clonidine	5	4.20%
Diuretics Total=22(18.4%)	Furosemide	18	15.12%
	Torsemide	4	3.366%
	Others	10	8.4%

5.21 UTILIZATION BASED ON TYPE OF THERAPY

The most prescribed combination among the antihypertensive drugs were the fixed dose combination of two diuretics such as furosemide, spironolactone, hydrochlorothiazide or torsemide and was found to have prescribed to 14 patients (44.44%), ARBs combined with diuretics (usually hydrochlorothiazide) that were prescribed among 6 patients (18.18%), beta blockers with CCBs as well as ACEIs were found to have prescribed to 6 patients each (18.18%). Other two drug combination prescribed included CCBs and ARBs that is in 3.3% of patients.

Table 3: Prescribing pattern of antihypertensive class given in combination.

Combination therapy	Number of patients	Percentage %
Fixed 2 diuretics	14	44.44
ARBs + Diuretics	6	18.18
CCBs + Beta blockers	6	18.18
ACEIs + Beta blockers	6	18.18
CCBs + ARBs	1	3.03

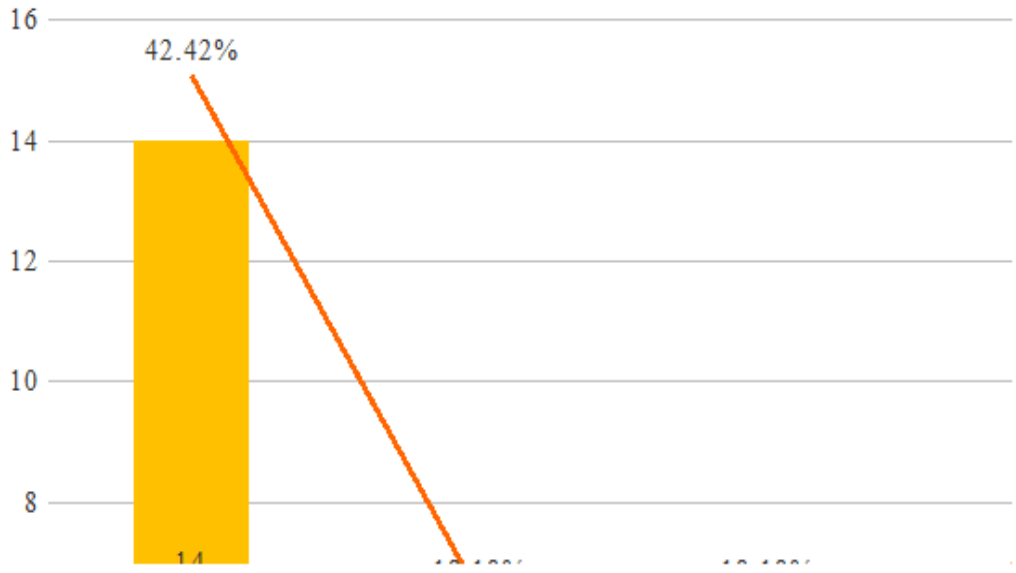

Fig 2. Prescribing pattern of antihypertensive class of drugs given in combination.

Furosemide combined with spironolactone makes most of the prescribed combinations that was found to be given to 8 patients (24.24%), hydrochlorothiazide+telmisartan, atenolol+telmisartan and atenolol+enalapril were presctibed among 6 patients each (18.18%). Spironolactone+torsemide was given among 4 patients (12.12%), whereas hydrochlorothiazide+furosemide, hydrochlorothiazide+spironolactone and amlodipine+losartan was prescribed to 1 patient each.

Table 4: Prescribing Pattern of Antihypertensive Drugs Given in Combination.

Fixed dose combination	Number of patients (33)	Percentage
Furosemide + Spironolactone	8	24.24%
Hydrochlorthiazide + Telmisartan	6	18.18%
Atenolol+ Amlodipine	6	18.18%
Enalapril + Atenolol	6	18.18%
Spironolactone + Torasemide	4	12.12%
Hydrochlorothiazide + Furosemide	1	3.03%
Hydrochlorthiazide + Spironolactone	1	3.03%
Amlodipine + Losartan	1	3.03%

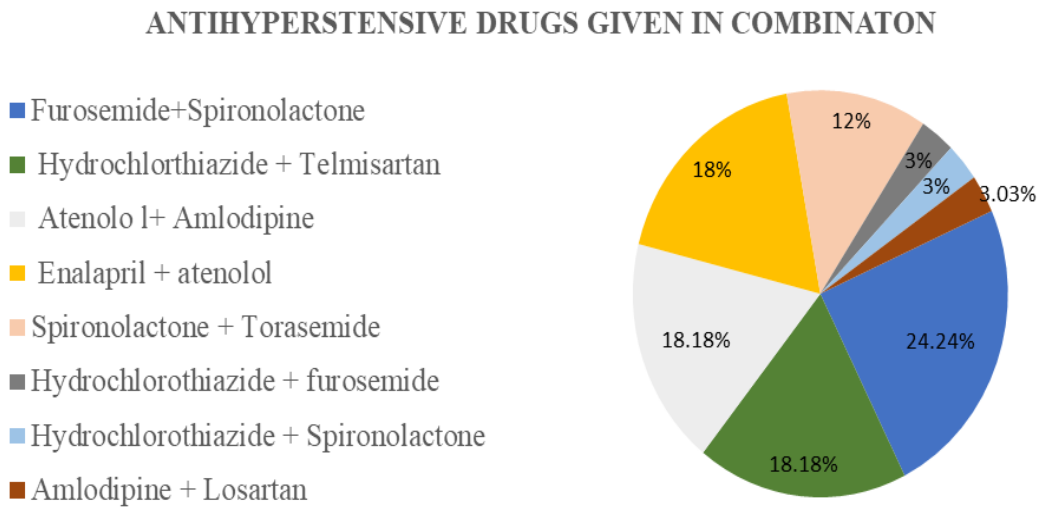

Fig 3: Prescribing pattern of antihypertensive drugs given in combination.

5.22 UTILIZATION STUDY BASED ON NUMBER OF ANTIHYPERTENSIVE DRUGS PRESCRIBED PER ENCOUNTER

The proportion of patients prescribed with number of antihypertensive drugs is shown in Table 5. In this study 40% of the patients had received two drug therapies, 39% of patients received one drug therapy while 14% received three drugs and 7% received four drugs alone or as in combination.

Table 5: Number of Antihypertensive drugs prescribed per encounter.

No. of Drugs	No. of patients
1	39
2	40
3	14
4	7

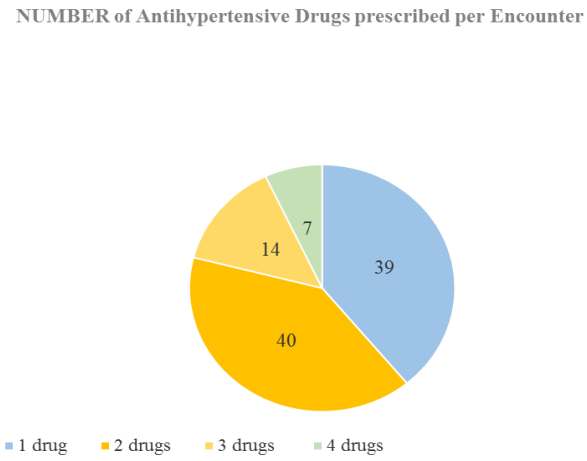

Fig 4: Number of Antihypertensive drugs prescribed per encounter.

Among single drug treatment, the most prescribed drugs were ARBs (12 patients), diuretics (8 patients), CCBs (7 patients), beta blockers and ACEIs were prescribed to 5 patients each as individual therapy. And 40 patients were prescribed with two drug combination therapy, ARBs with Diuretics were prescribed to 11 patients, ARBs with beta blockers were prescribed to 10 patients, ACEIs with beta blockers to 7 patients and 3 patients were prescribed with alpha blockers with CCBs and 3 patients with alpha blockers with diuretics. CCBs with beta blockers and ARBs with ACEIs were prescribed to two patients each. The patients who were prescribed with three drugs alone or in combination were beta blockers, ACEIs and CCBs or ARBs, CCBs and diuretics (3 patients); two patients were prescribed with ARBs, CCBs and beta blockers. Other three drug regimens were prescribed less frequently, and were found among only few prescriptions.

Table 6: Proportion of patients prescribed with anti-hypertensive drugs.

No. drugs	Drug Name	No. of patients
Single drug	ARBs	12
	Diuretics	8
	CCBs	7
	ACEIs	6
	Beta blockers	6
Two drugs	Two drugs	No. of patients
	ARBs, Diuretics	11
	ARBs, beta blockers	10
	ACEIs, beta blockers	7
	Alpha blocker, CCBs	3
	Alpha blockers, Diuretics	3
	CCB, beta blockers	2
	ARBs, ACEIs	2
Three drugs	Three	No. of patients
	□Bs, ACEIs, CCBs	3
	ARBs+CCBs , Diuretics	3
	ARBs, CCBs , beta blockers	2
	Diuretics, Alpha blockers, CCBs	1

5.3 COMPARISION OF PRESCRIBING PATTERN OF ANTIHYPERTENSIVE DRUGS USING JNC 7 GUIDELINES

In the present study the prevalence of Stage 1 hypertension is higher than other stages. Among 100 patients 40% of the patients had Stage 1 hypertension, 30% of the patients had Stage 2 hypertension, 27% of the patients had Pre-hypertension and the proportion in the normal stage was found to be 3%.

Table 7: Proportion of patients in each stage of Hypertension.

Stages of hypertension	Proportion of patients (%)
Normal	3%
Pre hypertension	27%
Stage 1 hypertension	40%
Stage 2 hypertension	30%

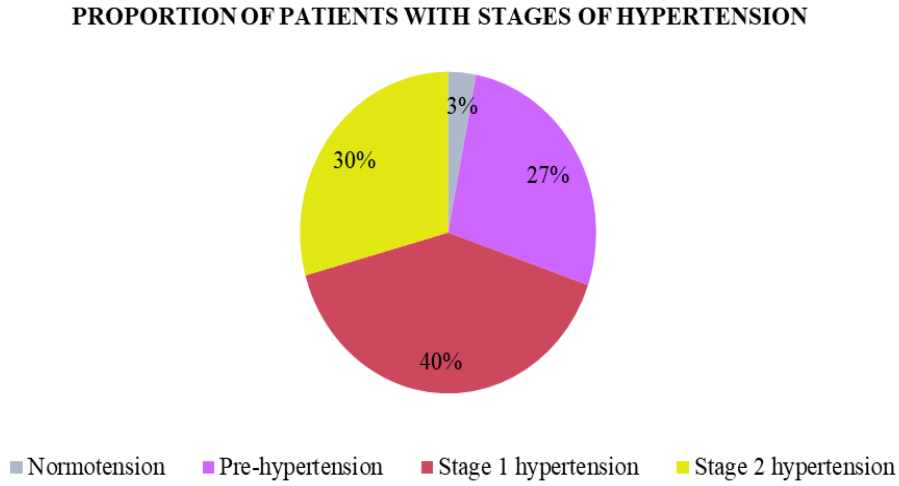

Fig 5. Proportion of patients in each stages of hypertension.

Table 8 shows the proportion of normotensive patients prescribed with each drug regimen. Among 3 normotensive patients, two were prescribed with diuretics and the rest were prescribed with angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers and calcium channel blockers as monotherapy.

Table 8: Proportion of normotensive patients prescribed with each drug regimen.

Antihypertensive drugs	Proportion of patients
Diuretics	2
ACE inhibitors	1
Adrenergic blockers	1
CCBs	1

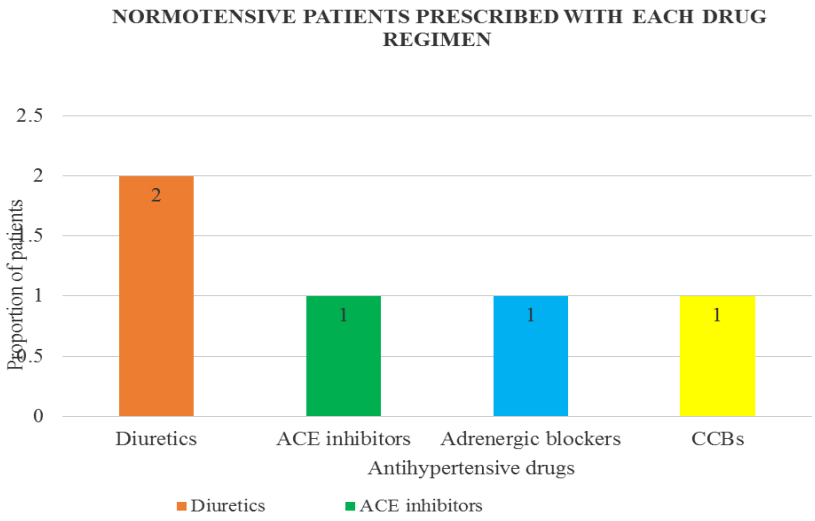

Fig 6. Proportion of normotensive patients prescribed with each drug regimen.

Table 9 shows the proportion of pre-hypertensive patients prescribed with each drug regimen. Among 27 pre-hypertensive patients, ARBs were the most commonly prescribed group of antihypertensive drugs given in 8 patients simultaneously higher than beta blockers given among 7 patients, CCBs and diuretics in 5 patients, and ACE inhibitors in 2 patients.

Table 9: Proportion of pre-hypertensive patients prescribed with each drug regimen.

Antihypertensive drugs	Proportion of patients
Diuretics	5
ACE inhibitors	2
ARBs	8
Beta blockers	7
CCBs	5

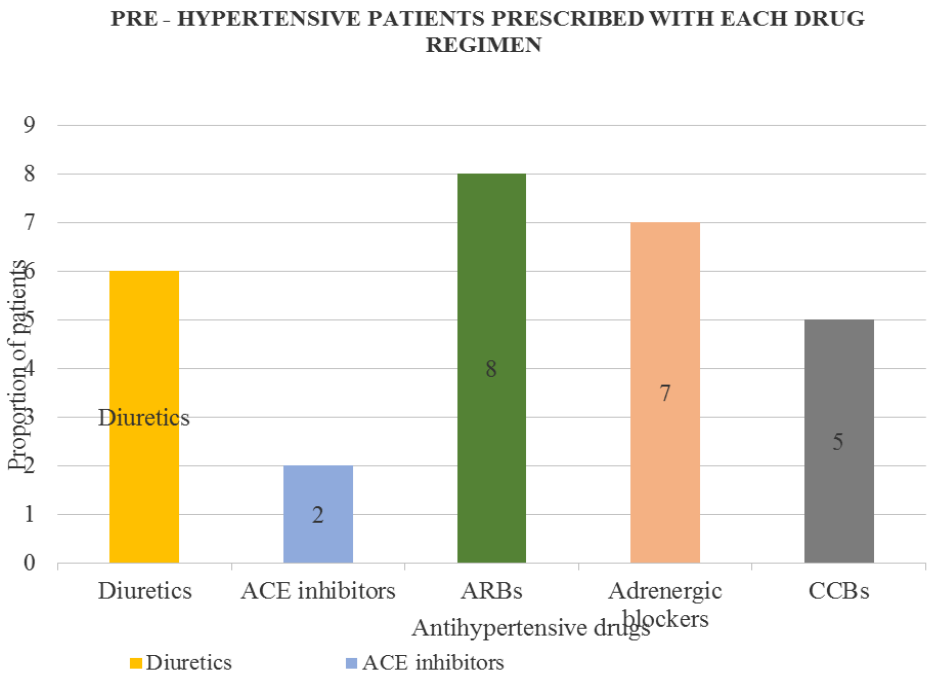

Fig 7. Proportion of pre-hypertensive patients prescribed with each drug regimen.

Table 10 shows the proportion of stage 1 hypertensive patients prescribed with each drug regimen; out of 40 Stage 1 hypertensive patients ARBs were prescribed among 11 patients that being the most commonly prescribed group of antihypertensive drugs, followed by thiazide diuretics in 10 patients and CCBs in 9 patients, ACE inhibitors in 8 patients and 5 patients received adrenergic blockers. 4 stage 1 hypertensive patients received fixed dose diuretics and 1 received the combination therapy of ARBs+Diuretics.

Table 10: Proportion of stage 1 hypertensive patients prescribed with each drug regimen.

Antihypertensive drugs	Proportion of patients
Thiazide diuretics	10
ACE inhibitors	8
ARBs	11
Adrenergic blockers	5
CCBs	9
Fixed dose combination of diuretics	4

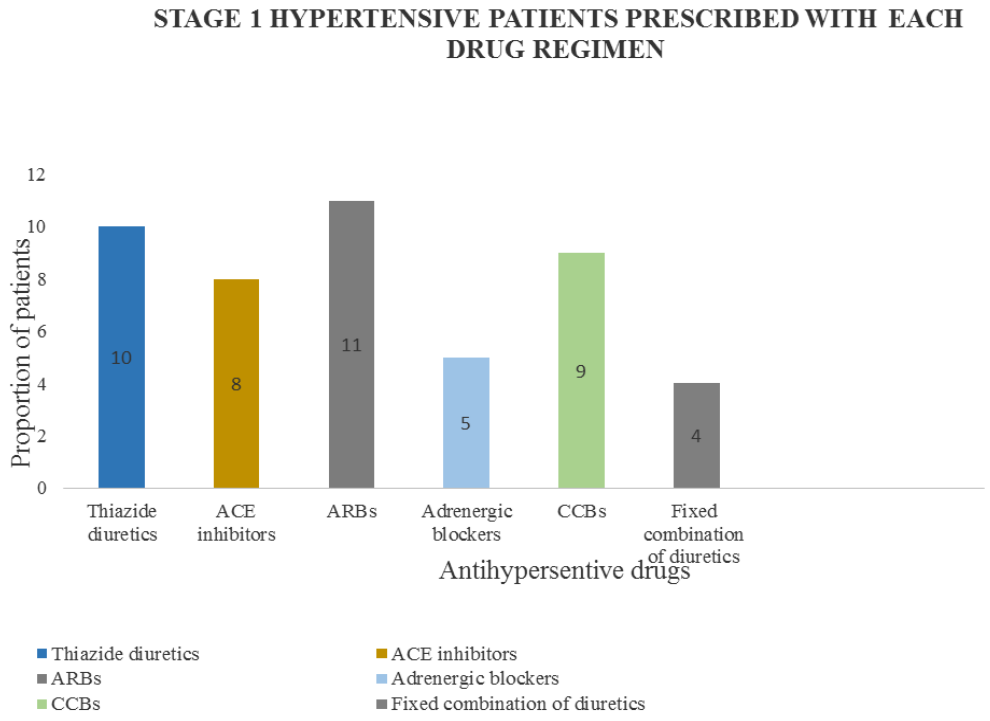

Fig 8. Proportion of stage 1 hypertensive patients prescribed with each drug regimen.

Table 11 shows the Proportion of stage 2 hypertensive patients prescribed with each drug regimen that among 29 Stage 2 hypertensive patients CCBs were the most commonly prescribed group of antihypertensive drugs being prescribed to 13 patients comparatively higher than fixed dose combination of diuretics given among 10 patients and ARBs in 7 patients, combination of ACEIs+beta blockers among 6 patients, ARBs+diuretics in 5 patients, adrenergic blockers were given to 2 patients whereas thiazide diuretics as monotherapy was given in one patient.

Table 11: Proportion of stage 2 hypertensive patients prescribed with each drug regimen.

Antihypertensive drugs	Proportion of patients
Thiazide diuretics	1
ARBs	7
Adrenergic blockers	2
CCBs	13
CCBs+ BBs	6
Fixed combination of diuretics	10
ACEIs+ BBs	6
ARBs+ Diuretics	5
ARBs+ CCBs	1

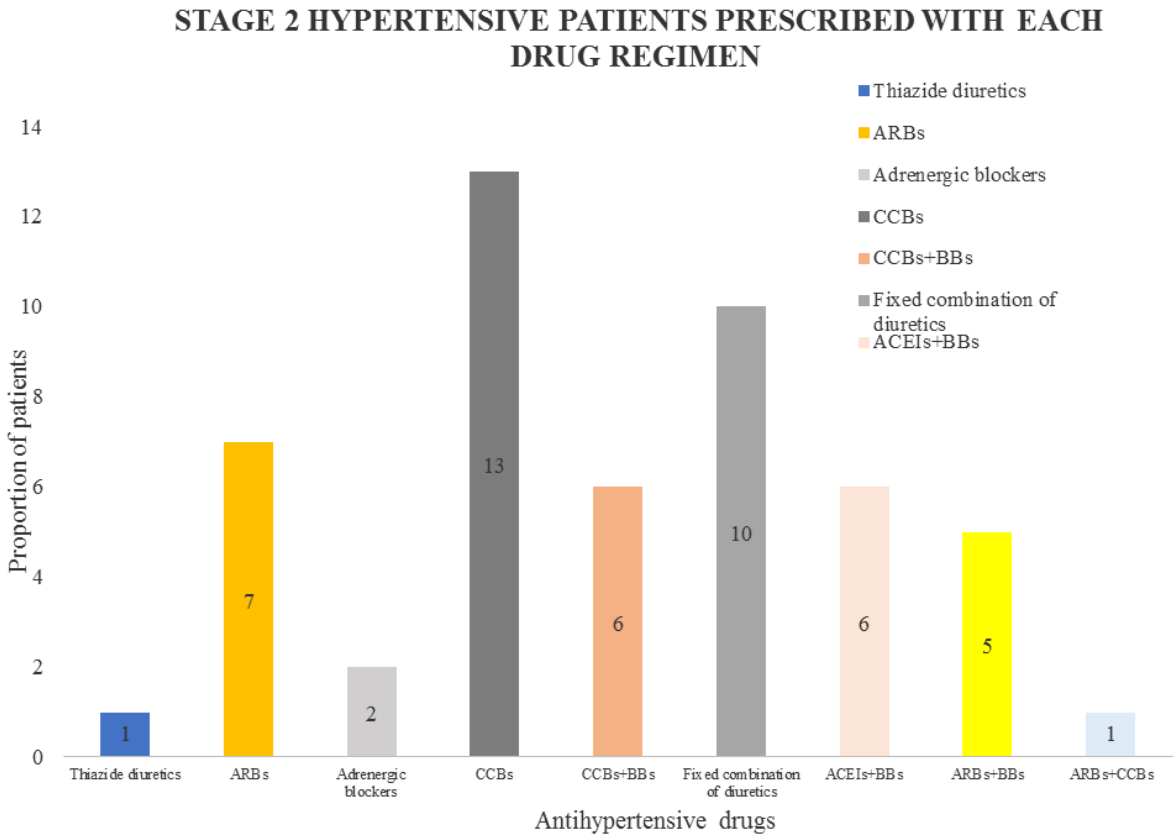

Fig 9. Proportion of stage 2 hypertensive patients prescribed with each drug regimen.

5.2 EFFECT OF CONCURRENT DISEASES ON TREATMENT OF HYPERTENSION

Table 12 depicts co-morbid conditions associated with Hypertension and table 13 depicts the utilization of antihypertensive drugs among patients with co-morbidities. According to the study, majority of the patients were suffering from concurrent diseases, among which

diabetes mellitus was found to be the most common being diagnosed among total of 62 patients. Other commonly associated conditions were coronary heart disease found among 36 patients, chronic kidney disease in 14 patients, respiratory illness in 12 patients and cerebrovascular diseases in 11 patients; thyroid disorder and heart failure was found to be among 6 patients each.

Table 12: Proportion of hypertensive patients associated with other co-morbid conditions.

Concurrent diseases	Number of patients
Type 2 Diabetes Mellitus	62
Coronary Artery Disease	36
Cerebro-vascular Disease	11
Heart Failure	06
Chronic kidney disease	14
Thyroid disease	06
Respiratory illness	12

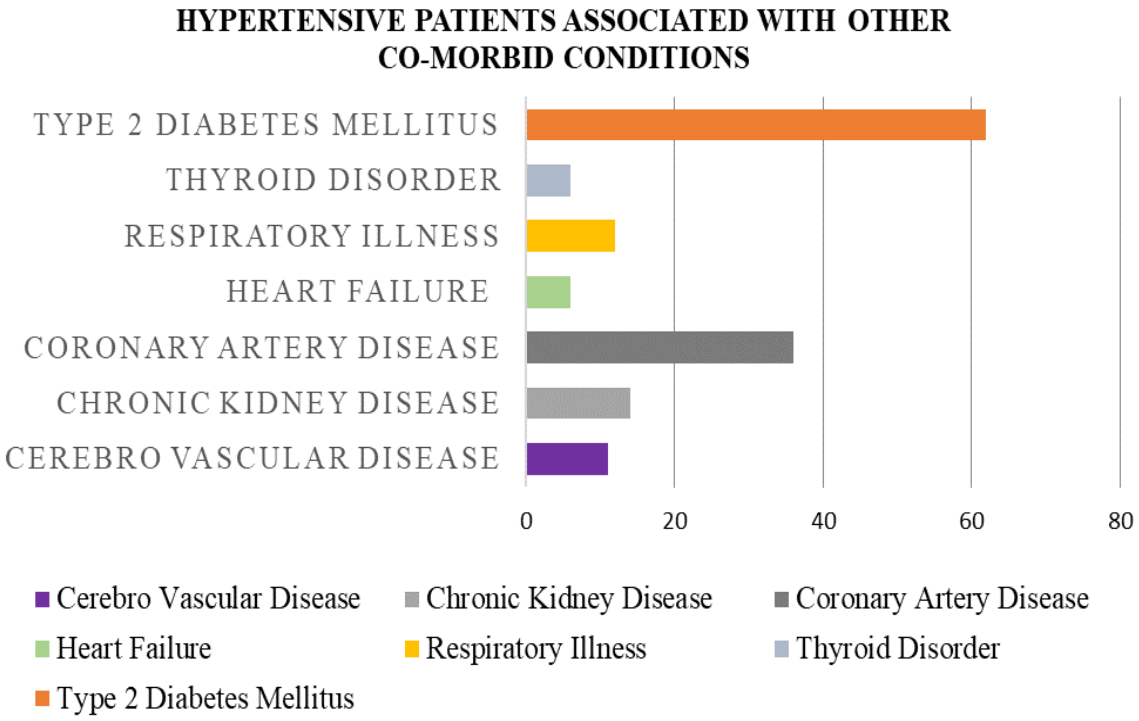

Fig 10. Proportion of hypertensive patients associated with other co-morbid conditions.

Among the commonly used drug groups prescribed along with antihypertensive drugs in the study subjects, hypoglycaemic drugs exceed all other drugs making the count to 60 patients, antiplatelet drugs were given to 19 patients, 13 patients were given with anti-asthmatics, 12 with hypolipidemic drugs and 9 patients were prescribed with antianginal drugs.

Table 13: Commonly used drug classes along with antihypertensive in study subjects.

Drugs	No. of patients
Hypoglycaemic drugs	60
Anti-platelet drugs	19
Anti-asthmatic drugs	13
Hypolipidemic drugs	12
Antianginal drugs	9

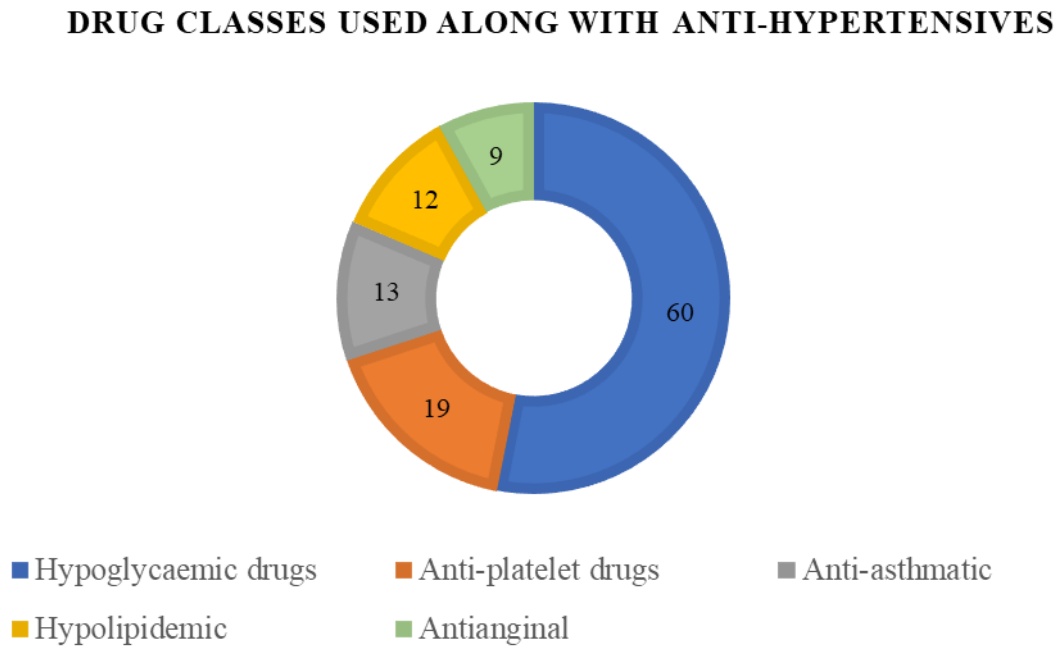

Fig 11. Commonly used drug classes along with antihypertensive in study subjects.

In patients with type 2 diabetes mellitus associated with hypertension, 62% had received single drug therapy in which the most prescribed drugs were CCBs being given to 22 patients (23.65%), fixed dose combinations and ARBs were prescribed to 19 patients (20.43%). Other commonly given drugs include adrenergic blockers being prescribed to 11 patients (11.82%) and ACEIs being prescribed to 7 patients (7.52%). Among patients diagnosed with cerebrovascular disease associated with hypertension, the most given drugs were fixed dose combinations, which were prescribed to 5 patients (29.41%), ARBs given to 4 patients (23.52%); CCBs and ACE inhibitors prescribed to 3 patients each (17.24%) and among coronary artery disease patients, combination therapy were given to most, making it to 12 patients (21.81%), ACE inhibitors in 11 patients (20%), ARBs given to 10 patients (18.18%) and CCBs to 9 patients (16.36%). These patients were given with diuretics and adrenergic blockers each as monotherapy (12.7% and 10.9% respectively) and the combination therapy given were among 12 patients (21.81%). Patients with heart Failure were prescribed with

ACE inhibitors and thiazide diuretics among 4 patients (28.57%), ARBs in 3 patients (21.42%); remaining 7.14% patients were given with combination therapy. And Patients with CKD were given with ACE inhibitors comprising of 8 patients (44.4%), diuretics (16.66%), whereas CCBs, fixed dose combinations and adrenergic blockers given among 2 patients (11.1%).

Table 14: Prescribing pattern of antihypertensive drugs among the patients with Co-existing diseases.

Drug class	No. of antihypertensive drugs prescribed				
	Patients with DM	Patients with CVD	Patients with CAD	Patients with HF	Patients with CKD
Thiazide diuretics	15 (16.12%)	1 (5.88%)	7 (12.7%)	4 (28.57%)	3 (16.66%)
ACE inhibitors	7 (7.52%)	3 (17.64%)	11 (20%)	4 (28.57%)	8 (44.4%)
ARBs	19 (20.43%)	4 (23.52%)	10(18.18%)	3 (21.42%)	1 (5.5%)
Adrenergic blockers	11 (11.82%)	1 (5.88%)	6 (10.9%)	0	2 (11.1%)
CCBs	22 (23.65%)	3 (17.64%)	9 (16.36%)	1 (7.14%)	2 (11.1%)
Fixed dose combination	19 (20.43%)	5 (29.41%)	12(21.81%)	2 (14.28%)	2 (11.1%)
Total	93	17	55	14	18

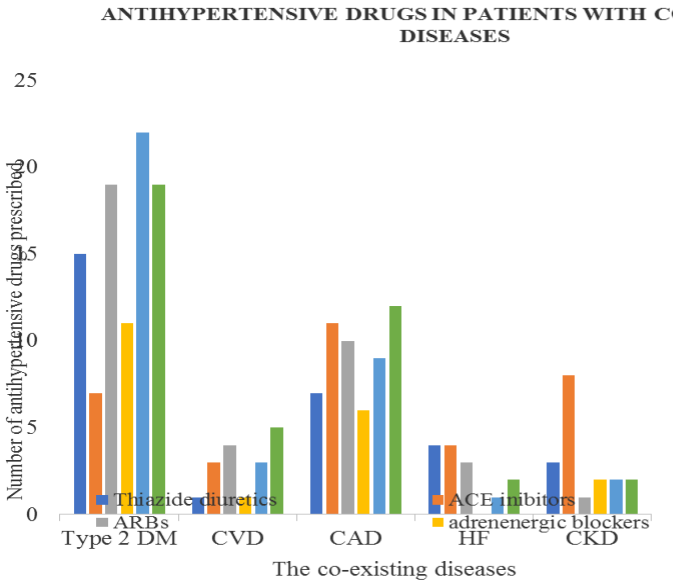

Fig 12. Prescribing pattern of anti-hypertensive drugs in patients with co-existing diseases.

5.5 THE PRESCRIBING PATTERN OF ANTIHYPERTENSIVE DRUGS DURING PANDEMIC

The prescribing pattern obtained from the current study was reviewed simultaneously and it was found that the pattern of antihypertensive prescription is not changed during the pandemic. According to the present study, telmisartan (ARBs) is the most prescribed antihypertensive drug, which makes up to 20 in count (16.8%). In total of 119 prescribed antihypertensive drugs, 29 were ARBs (24.36%) making it the most prescribed class of antihypertensive, which included losartan (5.88%) and olmesartan (1.68%) along with telmisartan. Besides the ARBs, 10 ACE inhibitors were prescribed (8.4%), which includes enalapril and ramipril (Table 2).

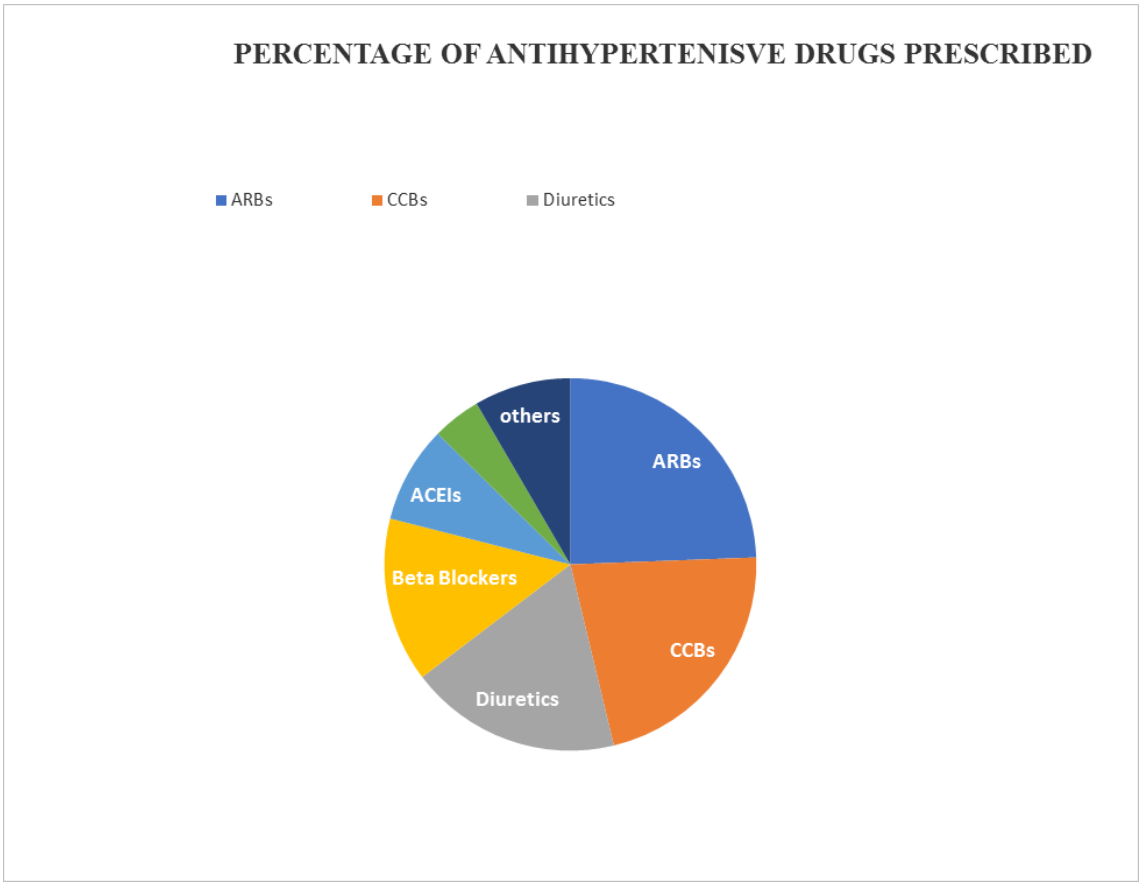

Fig 13: Percentage of ARBs and ACEIs prescribed among other antihypertensive drugs during COVID-19 pandemic.

CHAPTER 5: DISCUSSION

The main goal of antihypertensive therapy is to prevent hypertension related morbidity, mortality and complications. As antihypertensive prescription is required for a patient to keep the blood pressure in control, preventing the side effects and maintaining the quality of life

serve as the important aspects. Keeping all factors in mind, various prescribing guidelines have been formulated and treatment guidelines can be monitored by several methods, which includes drug utilization studies.

Hypertension is a chronic disease requiring lifelong treatment for the patients. Although lifestyle modifications play an important role in hypertension management, drugs also become unavoidable in many patients. This study analysed the demographic profile, prescription pattern of antihypertensive drugs and their rationality in comparison with JNC 7 guidelines among the hypertensive patients who were admitted in a tertiary care teaching hospital attached to the institution.

5.1 DEMOGRAPHIC DETAILS

Case files of 100 patients who met the eligibility criteria were analysed for drug utilization pattern evaluation. The demographic data of the patients revealed that the number of males (59%) were more than the number of females (41%).

The present study group showed a higher prevalence of hypertension in elderly patients (i.e., >65 years). However, most males showed an earlier onset of hypertension than females (i.e. 18% greater in males than in females). This was similar to the results demonstrated in the study conducted by Naik H G *et al.*,[6] concluding that the majority of the patients were in the age group of 60-69 (32.25%) and in the age group 70-79 (25.8%).

5.2 PRESCRIBING PATTERN OF ANTIHYPERTENSIVE DRUGS

Among the antihypertensive drugs, telmisartan (ARBs) was the most commonly prescribed drug 16.8%, which was found be slightly prescribed higher than amlodipine (CCBs) i.e. 13.4%, furosemide (loop diuretic) 15.12%, losartan (ARBs) 5.8%, atenolol and metaprolol (beta blocker) 5.04% each, nicardipine (CCBs), Clonidine (alpha agonist) each 6% and cilnidipine (CCBs) 4.2%.

The total of 152 antihypertensive drugs were prescribed to the patients and among them 78.29% of the patient received monotherapy and only 21.71% patients prescribed with combination therapy. This is comparable to the study conducted by Bhavika D *et al.*,[8] where maximum number of patients were on monotherapy (64.11%) and 31.89% of patients were found to be on two drug therapy. And the drug telmisartan (16.8%) was over-utilized and the drug Propranolol (1.68%) was underused among the patients as per the study. Among

combination therapy, fixed dose two diuretics consisting Furosemide, spironolactone, torsemide and/or Hydrochlorothiazide was highly utilized (44.44%) and in that furosemide+spironolactone were prescribed in 8 patients (24.24%). In this drug utilization study, the drugs were prescribed in a pattern such a way that 2 drugs were given in most of the patients (i.e. 40) being simultaneously higher that those prescribed with single drug (i.e. 39 patients) and 14 patients with 3 drug therapy whereas the rest 7 patients received 4 antihypertensive.

5.3 COMPARISION WITH JNC 7 GUIDELINES

Hypertension is placed into different categories as given by the JNC 7 guidelines, and the data analysis results showed that patients with stage 1 hypertension were observed in greater number (40%), followed by stage 2 hypertension (29%), prehypertension (27%) and normotension (3%). This finding was similar to the study conducted by Sapkota *et al.*,[3] where prevalence of stage 1 hypertension over other stages of hypertension was higher. In all stages of hypertension, the most frequently prescribed group of drugs were ARBs in prehypertension, which were followed by CCBs, thiazide diuretics, ACE inhibitors and beta blockers. In stage 1 hypertension, ARBs were followed by thiazide diuretics and CCBs. CCBs were also highly prescribed in stage 2, which were followed ARBs, thiazide diuretics, adrenergic blockers and ACE inhibitors.

5.4 EFFECT OF CONCURRENT DISEASES

Patients with chronic diseases like hypertension usually suffer from other associated conditions. In the present study, majority of the patients were suffering from concurrent diabetes mellitus (62%), coronary artery diseases (36%), chronic kidney disease (14%), respiratory illness (12%) and cerebrovascular disease (11%), Thyroid disorder and heart failure was found to be in 6% each. This shows similar outcome as that of the study conducted by Sapkota *et al.*,[3] where most of the patients were diagnosed with concurrent Diabetes Mellitus along with hypertension, which is simultaneously higher than coronary risk diseases. The patients with concurrent associated concurrent diseases are at greater risk of developing complications. Among the various diseases, cardiovascular diseases pose a major threat which requires multiple drugs for their management.

Prescribing pattern before and during COVID-19 pandemic

The article published by Clark C E *et al.*,[9] suggests that continuation of ACE inhibitors and ARBs during COVID-19 pandemic was safe. Simultaneously the current study was reviewed

for plausible changes in the prescribing pattern of antihypertensive drugs among the patients followed up during the covid-19 pandemic and the result was not found to be varied from the studies published before the COVID-19 pandemic. The study showed that the most prescribed drug was telmisartan (16.8%) and the total ARBs (24.35%) were prescribed most out of other classes of antihypertensive drugs, which concluded that the hospital did not switch to an alternative treatment for hypertension during the pandemic.

CHAPTER 7: SUMMARY

The present study was conducted to analyse the drug utilization pattern among hypertensive patients, mainly to identify the prescribing pattern of antihypertensive drugs, to compare that prescribing with JNC 7 guideline and to observe the effect of concurrent disease on hypertensive treatment. This prospective observational study involved a total of 100 case files collected from a hypertensive patient who were admitted in Tertiary care teaching hospital, Mukka, out of which 59% were male and 41% were female. Majority of the patients had diabetes mellitus as a concurrent disease (62%) compared to other diseases. And most patients were prescribed with 2 antihypertensive drugs (40%) or single drug (39%) followed by three (14%) and four (7%) antihypertensive drugs. From this data it could be noticed that the prevalence of co-morbidities has direct consequences on hypertension. Most of the patients were diagnosed as hypertensive after being admitted in the hospital for other co morbidities. Thus the education measures among the population regarding hypertension and consequences of inappropriate control of blood pressure may reduce the associated morbidity and mortality due to unawareness of the condition and the minimizes the cost burden incurred due to morbidities.

We conducted and analysed drug utilization pattern among the hypertensive patients and it was observed that ARBs are over utilized as monotherapy in comparison with CCBs and diuretics, which was supposed to be the first line choice of drugs. Among ARBs, telmisartan was the most prescribed drug (16.8%) followed by furosemide (15.12%), amlodipine (13.44%) and other drugs like propranolol (1.68%) was least commonly prescribed and among combination therapy, fixed combination of two diuretics were received by the most patient (44.44%).

In this study 40% of the patients were classified under stage 1 hypertension and they were highly prescribed with ARBs and thiazide diuretics. 29% of the patients had stage 2

hypertension and CCBs were prescribed most commonly as monotherapy where as two diuretics were prescribed commonly as combination therapy.

After analysing all the case files collected from the in-patients of a tertiary care teaching hospital, we found that the hospital is abiding to the guidelines of the seventh report of the Joint National Committee. In general, our data showed that 99% of the prescriptions support the JNC 7 guidelines.

CHAPTER 8: CONCLUSION

The present study provided a baseline data regarding the demographic details of hypertensive patients and prescribing pattern of the antihypertensive drugs. The age group of 65 years old and above have higher incidence of hypertension and monotherapy was recommended more in early stages of hypertension, out of which ARBs are utilized simultaneously higher than CCBs and diuretics to achieve target blood pressure.

In treatment of stage 2 hypertension, combination therapy serves as the first line agent as it is found to have prescribed among 96.5% of stage 2 hypertensive patients. As in combination therapy, utilization of diuretics combined with respective classes of drugs were found to be recommended consistently, followed by the combination of CCBs with beta blockers.

Study of utilization of antihypertensive drugs given in case of patients with concurrent diseases shows that CCBs serves as the single most prescribed antihypertensive class in diabetes mellitus, and in patients with coronary artery disease and cerebro-vascular diseases, fixed dose combinations were utilized consistently, whereas ARBs are found to have prescribed comparatively at higher rate among patients with other concurrent diseases.

The comparative study of the treatment pattern based on stages of hypertension and the comorbid conditions utilized in the hospital shows that the hospital is abiding to the guidelines of the seventh report of the Joint National Committee. And the simultaneous review done on the prescribing pattern shows that the hospital has not switched to an alternative treatment during the COVID-19 pandemic despite of the speculation that the patients on ARBs and ACE inhibitors are at high risk for acquiring the infection and the disease related complications.

Further studies on drug utilization pattern from time to time and the circulation of standard guidelines among prescribing physicians for the treatment of hypertension are required for the rational utilization of drugs in order to achieve maximal therapeutic efficacy.

CHAPTER 9: BIBLIOGRAPHY

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