TuijinJishu/Journal of Propulsion Technology
ISSN: 1001-4055
Vol. 45 No. 2 (2024)

Study of Prescribing Patterns of Anti-Hypertensive Agents in Hypertensive Diabetic Patients at a Tertiary Care Hospital

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Abstract
Hypertension, Also Known As High Or Raised Blood Pressure, Is A Condition In Which The Blood Vessels Have Persistently Raised Pressure. Diabetes Mellitus Is A Syndrome Of Multiple Etiologies Characterized By Chronic Hyperglycemia With Disturbances Of Carbohydrate, Fat And Protein Metabolism Resulting From Defects In Insulin Secretion, Insulin Action Or Both. An Estimated 1.28 Billion Adults Aged 30–79 Years Worldwide Have Hypertension, Most (Two-Thirds) Living In Low- And Middle-Income Countries. Overall, Hypertension Is Disproportionately Higher In Diabetics, While Persons With Elevated Bp Are Two And A Half Times More Likely To Develop Diabetes Within 5 Years. In India, About 50% Of Diabetics Have Hypertension. Overall Prevalence For Hypertension In India Was 29.8%. Prescribing Pattern Describe The Nature, Profile Of Drug Usage, And Compliance With Regional, State, Or National Guidelines, Such As Uniform Prescribing Patterns, The Use Of Drugs From The List Of Essential Medicines, And The Use Of Generic Drugs. Appropriate Prescription Has A Beneficial Effect On Adherence And Disease Prevention. The Purpose Of Prescribing Pattern Analysis Is To Ensure Rational Use Of Drugs, Prescribed With Complete Knowledge On Safety And Tolerability Of Regimen And Controlling Not Only Current Ailment But Also The Comorbid Conditions. The Objective Of This Study Is Drug Utilization Evaluation (Due) Of Antihypertensive Agents In Hypertensive Diabetic Patients.
Keywords: Hypertension, Diabetes Mellitus, Prescribing Pattern, Antihypertensive Agents, Drug Utilization Evaluation

introduction

Hypertension and diabetes are becoming increasingly common. Hypertension occurs more commonly in diabetics than in comparable nondiabetics. Hypertension (defined as a blood pressure [BP] ≥140/90 mmHg) affects 20 to 60% of patients with diabetes, depending on obesity, ethnicity, and age. Overall, hypertension is disproportionately higher in diabetics, while persons with elevated BP are two and a half times more likely to develop diabetes within 5 years. In India, about 50% of diabetics have hypertension.[1]

The incidence of hypertension in patients with type 2 diabetes mellitus is approximately two-fold higher than in age- matched subjects without the disease. The prevalence of hypertension coexisting with diabetes appears to be increasing mainly in ageing population as both hypertension and non-insulin dependent diabetes mellitus incidence increases with age.[2]

Tight control of blood glucose only decreases the risk of microvascular complications, whereas tight control of BP reduces both micro and macro vascular complications. Tight BP control is more cost effective and easier for clinicians and patients than tight blood glucose control. The International Diabetic Federation Consensus Guidelines have shown reduction in stroke morbidity and mortality, heart failure morbidity and mortality, reduced left ventricular hypertrophy, decrease in CAD events, and reduction in progression of renal disease including diabetic nephropathy, by tight control of hypertension in diabetics. [3]

The Eighth Joint National Committee i.e., JNC-8 guidelines recommends that blood pressure (BP) in diabetics be controlled to levels of 140/90 mmHg or lower. Reasons behind this is mainly due to the occupancy of renal

insufficiency in the diabetic patient may impair the ability to excrete water and solutes, thus perpetuating the volume expansion that was induced by hyperglycemia and/or sodium excess. The contribution of renin-angiotensin-aldosterone system to the hypertension of diabetes is also a main factor. Whatever the goal level, optimal control of BP is paramount for reducing the progression of diabetic nephropathy to end stage renal disease and other complications.[4]

Drug Utilization Evaluation (DUE) is an authorized and structured ongoing review of practitioner prescribing, pharmacist dispensing and patient use of medications. The purpose of DUE is to ensure drugs are used appropriately, safely and effectively to improve patient health status. It evaluate and analyze the drug therapy in HTN associated with DM which is very essential from time to time to observe the prescribing attitude of physicians with the aim of rational use of drugs and to minimize the adverse drug reactions.[5]

Prescribing pattern describe the nature and profile of drug usage, and compliance with regional, state, or national guidelines, such as uniform prescribing patterns, the use of drugs from the list of essential medicines, and the use of

generic drugs. Appropriate prescription has a beneficial effect on adherence and disease prevention. Patient factors like age, sex, BMI, coexisting illness, and mainly their socioeconomic status will all determine the prescription pattern. During prescription writing along with current ailment and comorbid the knowledge of safety and tolerability of regimen is also of prime importance because it leads to prevent the future hallmarks of the prescribed therapy.[6]

This study was conducted with the objective of assessing the prescribing pattern of antihypertensive drugs in hypertensive diabetic patients in clinical settings. Further, the study also assessed the rationality and adherence of prescribing pattern with JNC-8 hypertension management guidelines. Ultimately, such a study will improve the quality of prescriptions and will provide a greater benefit to the patient.[7]

Diabetes mellitus (formerly called non–insulin-dependent diabetes) is a syndrome of multiple etiologies characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. This disorder is often associated with long term complications, involving organs like eyes, kidneys, nerves, heart and blood vessels.[8] Insulin resistance is a major contributor to progression of the disease and to complications of diabetes.[9] The International Diabetes Federation (IDF) estimates that there are 72.9 million people with diabetes in India in 2017, which is projected to rise to134.3 million by the year 2045.[10]

Hypertension:

According to WHO, Hypertension (high blood pressure) is when the pressure in your blood vessels is too high (140/90 mmHg or higher).[11] It is also defined as persistently elevated arterial blood pressure (BP). Isolated systolic hypertension is diastolic blood pressure (DBP) values less than 90 mm Hg and systolic blood pressure (SBP) values of 140 mm Hg or more.

CLASSIFICATION

The Eighth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 8) classifies adult BP as shown in Table:

Classification	Systolic (mm Hg)		Diastolic (mm Hg)
Normal	<120	and	<80
Prehypertension	120–139	or	80–89
Stage 1 hypertension	140–159	or	90–99
Stage 2 hypertension	≥160	or	≥100

Table 1: Classification of Blood Pressure in Adults

Hypertensive crisis (BP >180/120 mm Hg) may be categorized as hypertensive emergency with extreme BP elevation with acute or progressing target-organ damage) or hypertensive urgency (high BP elevation without acute or progressing target-organ injury).[12]

An estimated 1.28 billion adults aged 30–79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries. Hypertension is a major cause of premature death worldwide. One of the global targets for non- communicable diseases is to reduce the prevalence of hypertension by 33% between 2010 and 2030.[13]Overall prevalence for hypertension in India was 29.8% (95% confidence interval: 26.7–33.0). Significant differences in hypertension prevalence were noted between rural and urban parts [27.6% (23.2–32.0) and 33.8% (29.7–37.8); P = 0.05]. About 33% urban and 25% rural Indians are hypertensive.

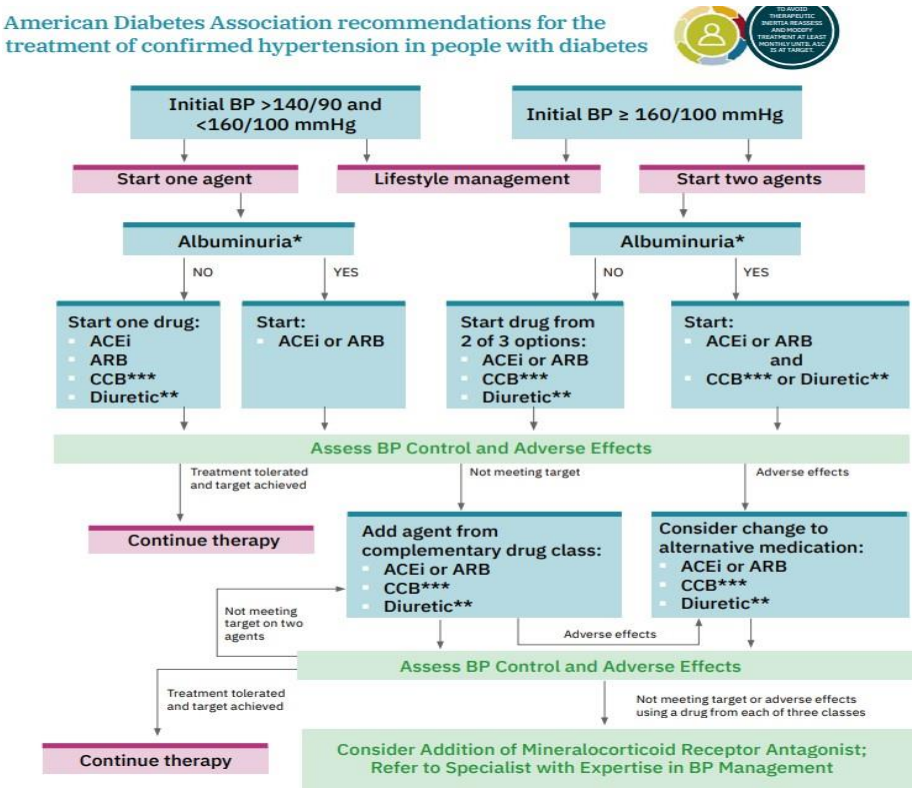
TREATMENT:

Management of hypertension - Many guidelines exist for the management of hypertension. Most groups, including the JNC, the American Diabetes Associate (ADA), and the American Heart Association/American Stroke Association (AHA/ASA) recommend lifestyle modification as the first step in managing hypertension. The choice of perfect antihypertensive remains elusive and dictated by patient's age, associated comorbidities such as chronic kidney disease (CKD), CAD, state of diabetes and hypertension, and other factors:

- Angiotensin-converting enzyme (ACE) inhibitors, angiotensin II receptor blockers (ARBs), calcium channel blockers (CCBs), and thiazide diuretics are acceptable first-line options for diabetic hypertensives.
- β-Blockers are used to either treat a specific compelling indication or as combination therapy with a first-line antihypertensive agent for patients without a compelling indication.
- Most patients with stage 1 hypertension should be treated initially with a first-line antihypertensive drug or a two-drug combination. Combination therapy is recommended for patients with stage 2 hypertension, preferably with two first-line agents.
- There are six compelling indications where specific antihypertensive drug classes provide unique benefits.
- Other antihypertensive drug classes (α1-blockers, direct renin inhibitors, central α2-agonists, peripheral adrenergic antagonists, and direct arterial vasodilators) are alternatives that may be used for select patients after first-line agents.[14]

GUIDELINES FOR MANAGING DIABETIC HYPERTENSIVES:

- The target BP should be below 130/80 mm Hg.
- All routinely used antihypertensive drugs have been shown to be beneficial compared with placebo.
- More than one drug will usually be required to achieve the target BP.
- Patients with prehypertension (130-139/80-89 mmHg) should be given lifestyle/behavioural therapy alone for a maximum of 3 months and then, if targets are not achieved, should also be treated pharmacologically. Attention should be paid to lifestyle changes (weight reduction; regular exercise; and moderation of sodium, protein, and alcohol), as well as control of hyperglycaemia, dyslipidaemia, and proteinuria, for all the patients.
- The choice of drugs should always include an ACE inhibitor (or an angiotensin II receptor blocker, if ACE inhibitors cannot be tolerated) and should usually include a diuretic. If additional therapy is needed, a calcium- channel blocker, β-blocker, or α-blocker may be used. [15]



Algorithm 1: Standard algorithm for treatment of hypertension[16]

Materials And Methods

MATERIALS:

Patient Informed Consent Form (ICF) Patient data collection form Questionnaire form

Patient information Sheet

Study design: Prospective Observational Cohort study

Study population: 250 cases with complete data were screened and used for evaluation.

Study site: The study has been conducted in Gayatri Vidya Parishad Institute of Health Care & Medical Technology, KIMS Hospital and other clinics in and around Visakhapatnam.

Study period: The study was conducted for a period of 6 months.

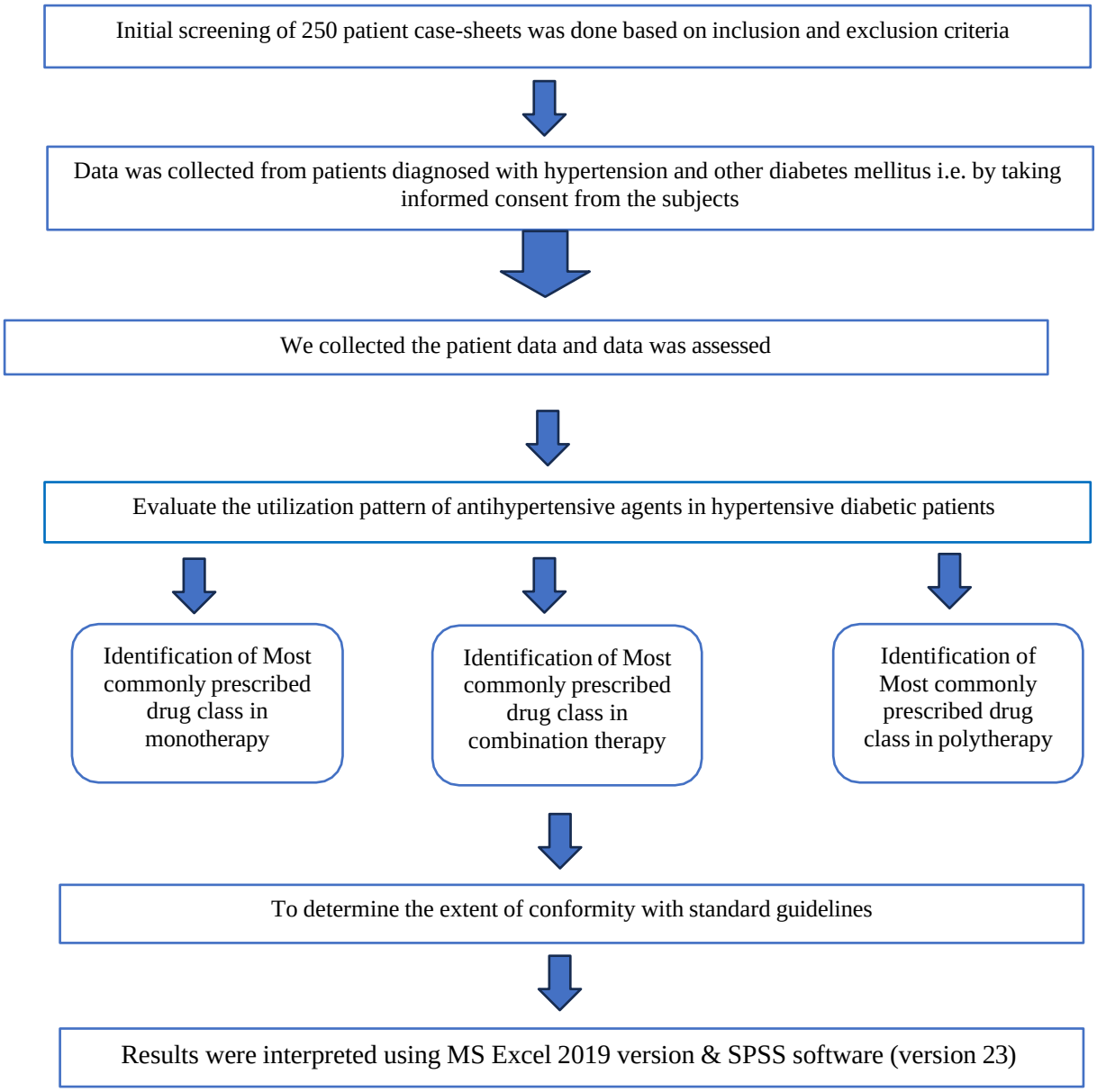
INCLUSION CRITERIA

- Patients who are willing to participate in the study with age >18 years of either gender were included.
- Only those patients who are diagnosed with Hypertension and diabetes mellitus are recruited.

EXCLUSION CRITERIA

- Patients who are not willing to participate in the study
- Pregnancy and lactating women are excluded
- Cancer patients are excluded
- <18 years old patients are excluded

METHODOLOGY FLOWCHART:



Algorithm 2: Methodology flow chart

RESULTS & DISCUSSION

***Data organized using MS Excel 2019 version and represented through bar charts and pie charts*

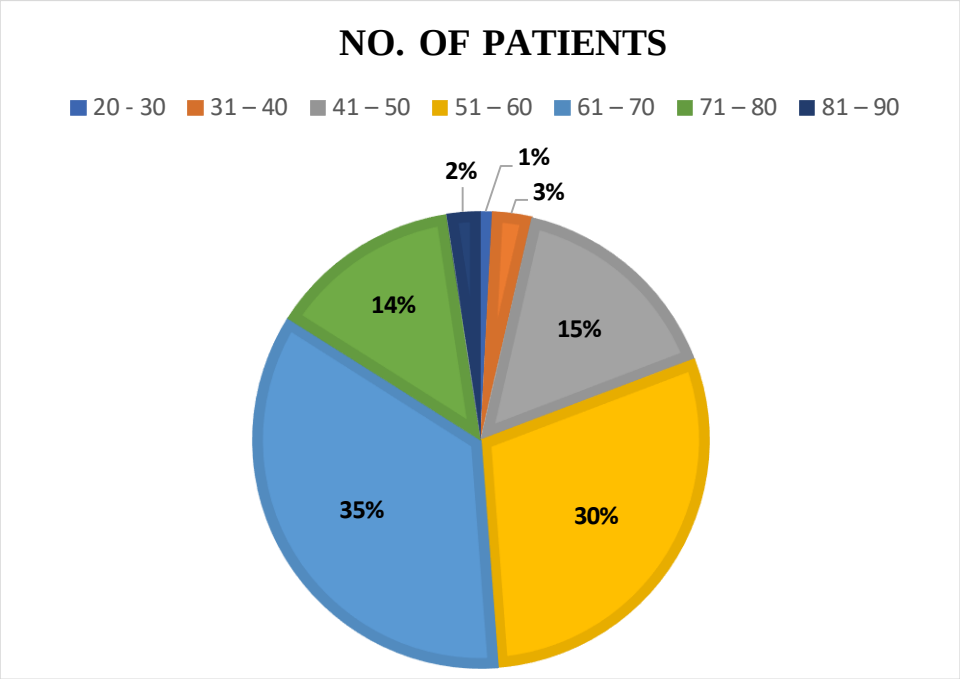
1) AGE:

In the present observed study, a total of 250 patient cases were screened, in which patients were divided into 7 groups depending on the ages, i.e., 20 - 30, 31 - 40, 41-50, 51- 60, 61- 70, 71-80, 81-90 & ≥ 90 years. The age group of the patients varies from 20 to 90 years. The majority of patients lie in the age range of 61-70 years (35%) followed by 51-60 years (30%) (Graph 1).

Age (years)	No. of patients
20 - 30	2
31 – 40	7
41 – 50	39
51 – 60	74
61 – 70	88
71 – 80	34
81 – 90	6
Total	250

Table 3: Demographic representation of Age of the patients

Graph 1: Percentage distribution of patients as per their age group

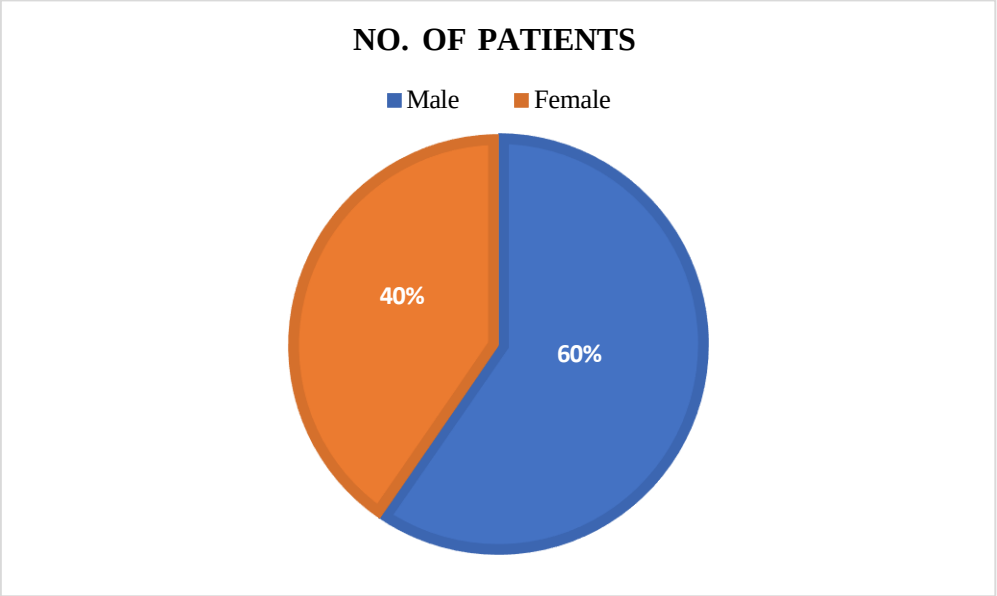


2) GENDER:

In the present observed study, a total of 250 patient cases were screened, of which 149 were male and 101 were female. Male patients were slightly higher than female patients with a difference of 20% (Graph 2)

Gender	No. of patients
Male	149
Female	101
Total	250

Table 4: Demographic representation of Gender of the patients



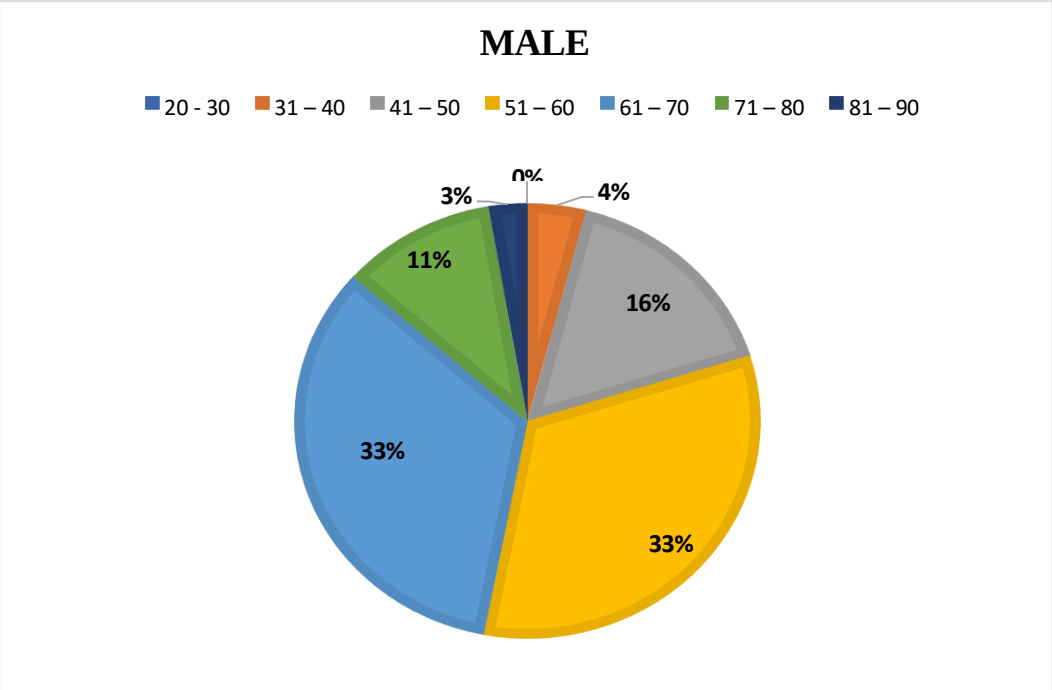
Graph 2: Percentage distribution of patients as per their gender

a) Male patients: As stated above we categorized the patients in 7 different age groups and considered both genders. Among 250 patients, 149 were male patients where we observe greater incidence of 33% involving 50 patients & 49 patients in both age groups of 51-60 years, 61-70 years followed by incidence of 16% & 11% in age groups of 41-50 years & 71-80 years respectively.

Age (years)	Male
20 - 30	0
31 – 40	6
41 – 50	24

51 – 60	49
61 – 70	50
71 – 80	16
81 – 90	4
Total	149

Table 5: Demographic representation of Male patients



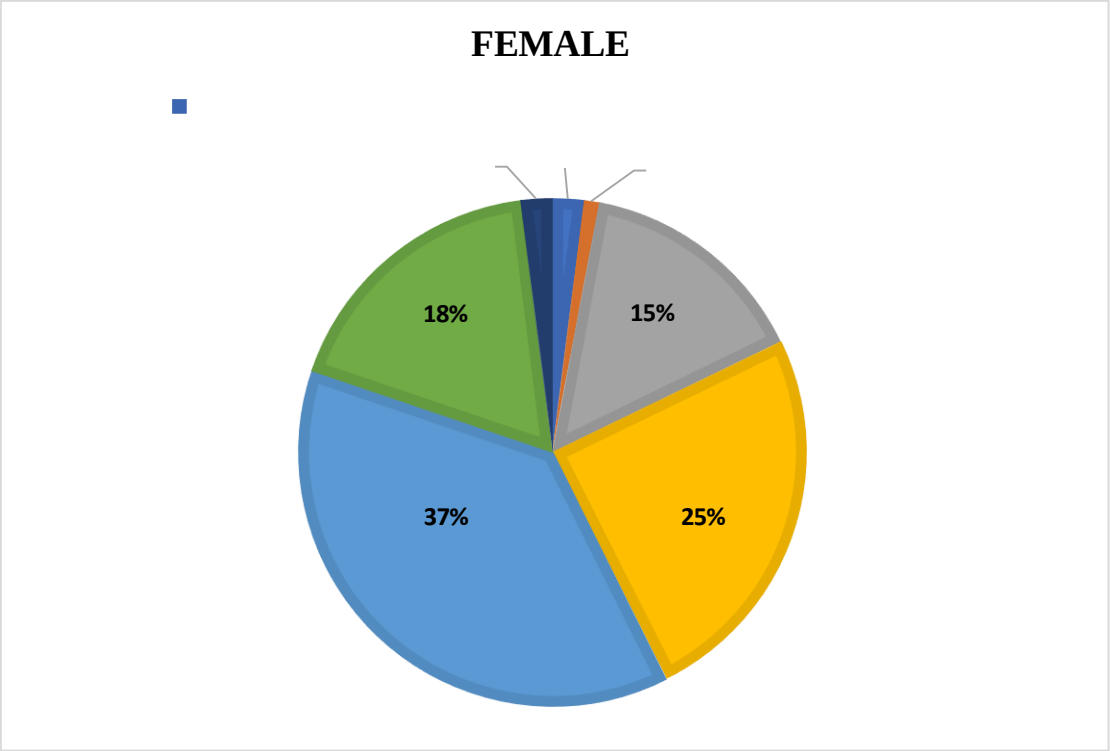
Graph 4: Percentage distribution of Male patients

b) Female patients: As stated above we categorized the patients in 7 different age groups and considered both genders. Among 250 patients, 101 were female patients where we observe greater incidence of 37% & 25% involving 38 patients & 25 patients in both age groups of 61-70 years, 51-60 years followed by incidence of 18% & 15% in age groups of 71-80 years & 41-50 years respectively.

Age (years)	Female
20 - 30	2
31 – 40	1
41 – 50	15
51 – 60	25
61 – 70	38
71 – 80	18
81 – 90	2
Total	101

Table 6: Demographic representation of Female patients

0 - 30	31 – 40	41 – 50	51 – 60	61 – 70	71 – 80	81 – 90
		2%	2%	1%		



Graph 5: Percentage distribution of Female patients

3) TO EVALUATE THE UTILIZATION PATTERN OF ANTIHYPERTENSIVE AGENTS AMONG TYPE-2 DIABETIC PATIENTS WITH HYPERTENSION:

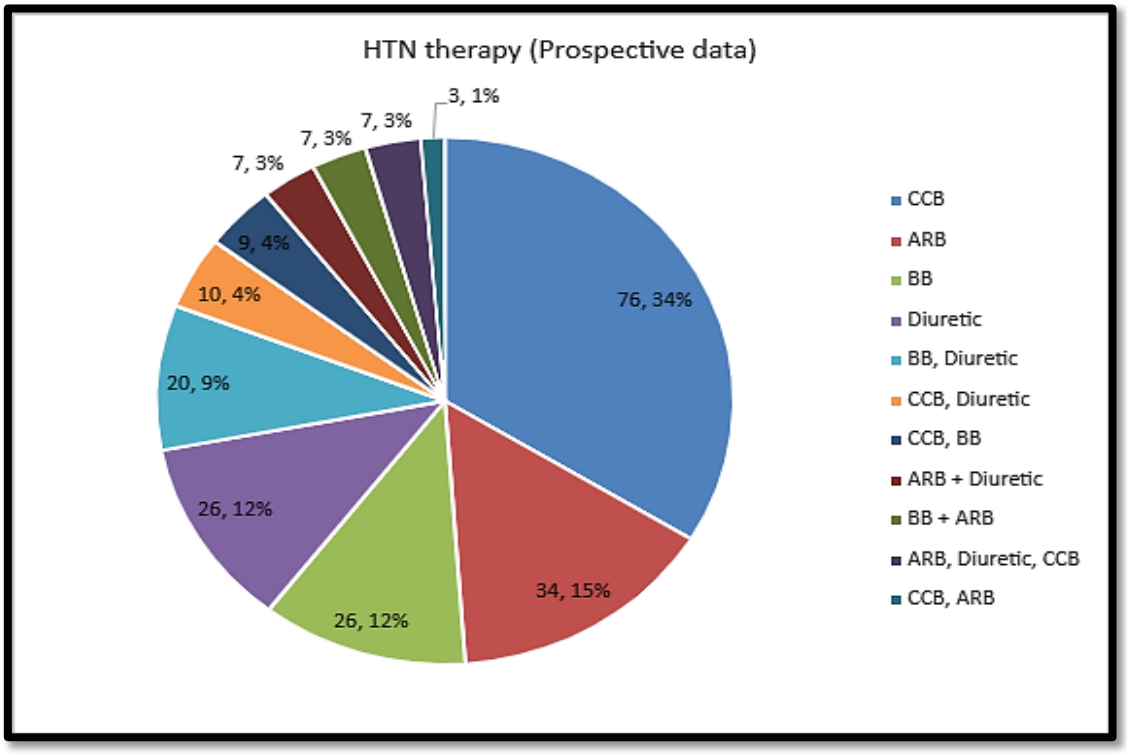
Among 250 patients, 76 patients were administered with CCB (34%) followed by 34 with ARB (15%), 26 with

Beta-blockers (12%), 26 with Diuretics (12%), 20 with Beta-blockers and Diuretic (09%). Other medications were prescribed in less number, either in fixed combinations or single therapy or polytherapy (Graph 6).

Antihypertensive therapy for patients with HTN + Type-2 DM	**No. of patients**
CCB	76
ARB	34
BB	26
Diuretic	26
BB, Diuretic	20
CCB, Diuretic	10

CCB, BB	9
ARB + Diuretic	7
BB + ARB	7
ARB, Diuretic, CCB	7
CCB, ARB	3
Alpha-2 agonist, CCB + BB	3
Alpha-2 agonist, CCB	3
ARB, Diuretic	2
BB, ARB, Diuretic	2
Alpha-1 blocker, CCB	2
CCB + BB	1
BB, ARB	1
CCB, BB, Diuretic	1
Alpha-2 agonist	1
ACE inhibitor	1
Diuretic, ARB + BB	1
BB, Diuretic, ACE inhibitor	1
Alpha-2 agonist, BB, Diuretic	1
BB + ACE inhibitor	1
BB, CCB, ARB	1
Alpha-1 blocker, CCB, Diuretic	1
ACE inhibitor, CCB, Diuretic	1
Alpha-1 blocker, ARB	1
TOTAL	250

Table 7: Distributed number of patients based on antihypertensive therapy



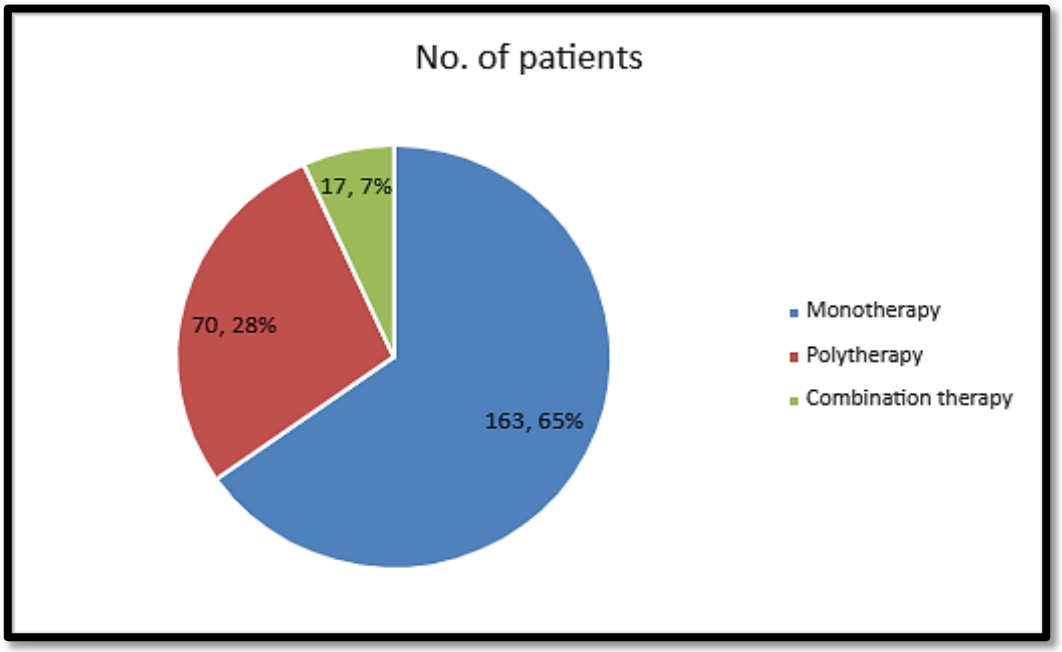
Graph 6: Percentage representation of antihypertensive therapy administered to number of patients

4) Type of antihypertensive therapy for HTN + Type-2 DM patients

Monotherapy was administered in 163 patients (65%), Polytherapy in 70 patients (28%), fixed combination therapy in 15 patients (7%).

ype of antihypertensive therapy for HTN + Type-2 DM patients	No. of patients
Monotherapy	163
Polytherapy	70
Combination therapy	17
TOTAL	250

Table 8: Distribution of number of patients based on type of antihypertensive therapy



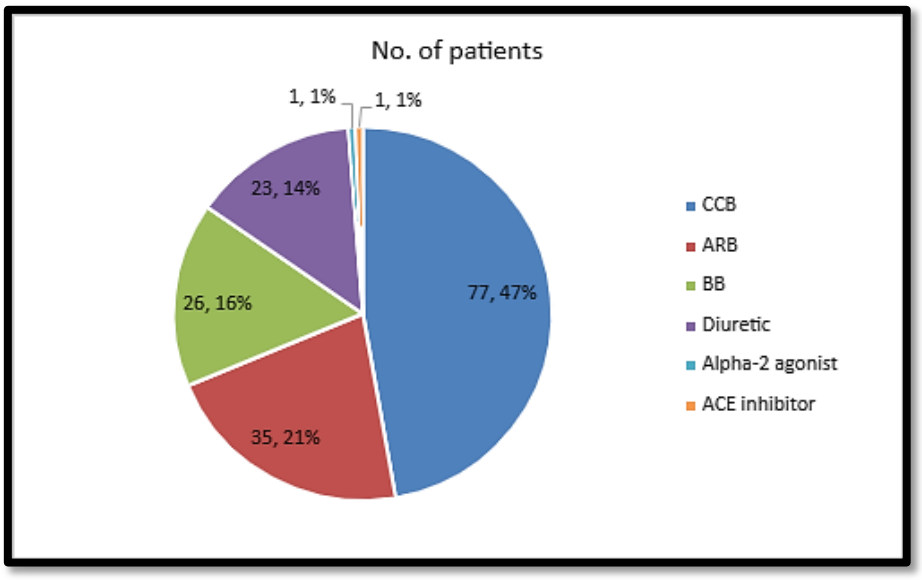
Graph 7: Percentage representation on type of antihypertensive therapy used for treatment of hypertensive diabetic patients

A) Monotherapy given for Hypertensive diabetic patients (Antihypertensives):

In monotherapy, CCB (47%) was mostly prescribed drug followed by ARB (21%), Beta-blockers (16%), Diuretics (14%), and others in less number.

Monotherapy given for Hypertensive diabetic patients (Antihypertensives)	**No. of patients**
CCB	77
ARB	35
BB	26
Diuretic	23
Alpha-2 agonist	1
ACE inhibitor	1
TOTAL	163

Table 9: Distribution ofdrug class prescribed in antihypertensive monotherapy



Graph 8: Percentage representation of drug class prescribed in antihypertensive monotherapy

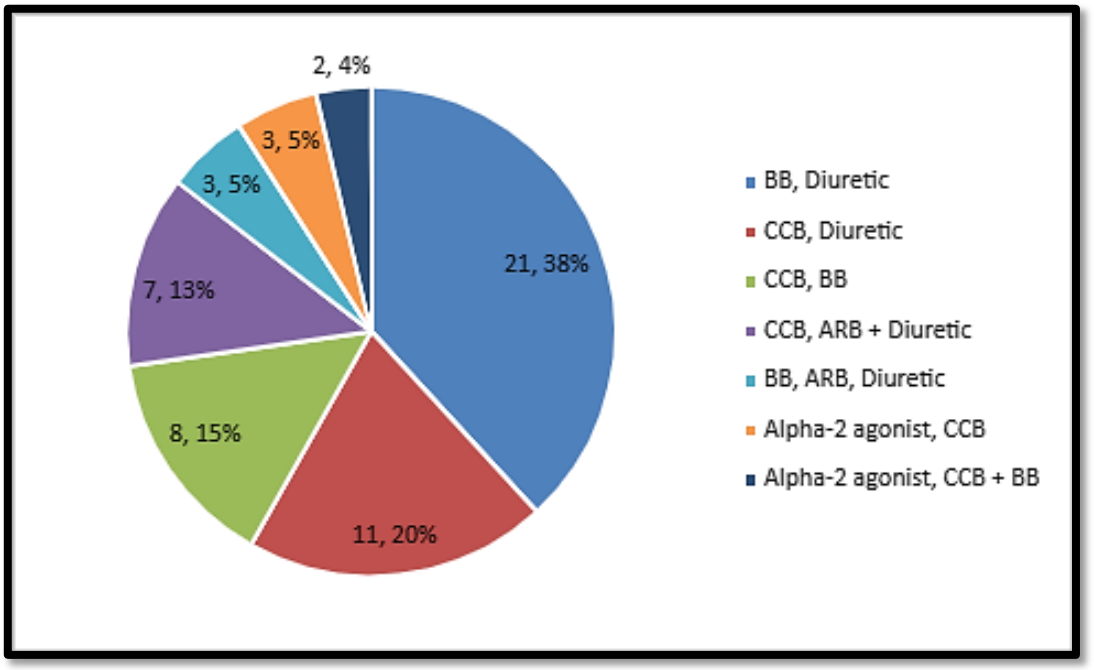
B) Polytherapy given for Hypertensive diabetic patients (Antihypertensives):

In polytherapy, Beta-blockers and Diuretics (38%) were mostly prescribed followed by CCB and Diuretics (20%), CCB and Beta-blockers (15%), CCB, ARB and Diuretics (13%) and others in less number.

Polytherapy given for Hypertensive diabetic patients (Antihypertensives)	**No. of patients**
BB, Diuretic	21
CCB, Diuretic	11
CCB, BB	8
CCB, ARB + Diuretic	7
BB, ARB, Diuretic	3
Alpha-2 agonist, CCB	3
Alpha-2 agonist, CCB + BB	2
Alpha-1 blocker, CCB	2
CCB, ARB	2
ARB, Diuretic	2
BB, ARB	1
BB, Diuretic, ACE inhibitor	1
Alpha-2 agonist, BB, Diuretic	1
BB, CCB, ARB	1
BB, ARB + Diuretic	1
Alpha-1 blocker, CCB, Diuretic	1

ACE inhibitor, CCB, Diuretic	1
BB, CCB, Diuretic	1
Alpha-1 blocker	1
TOTAL	70

Table 10: Distribution of drug classes prescribed in antihypertensive polytherapy



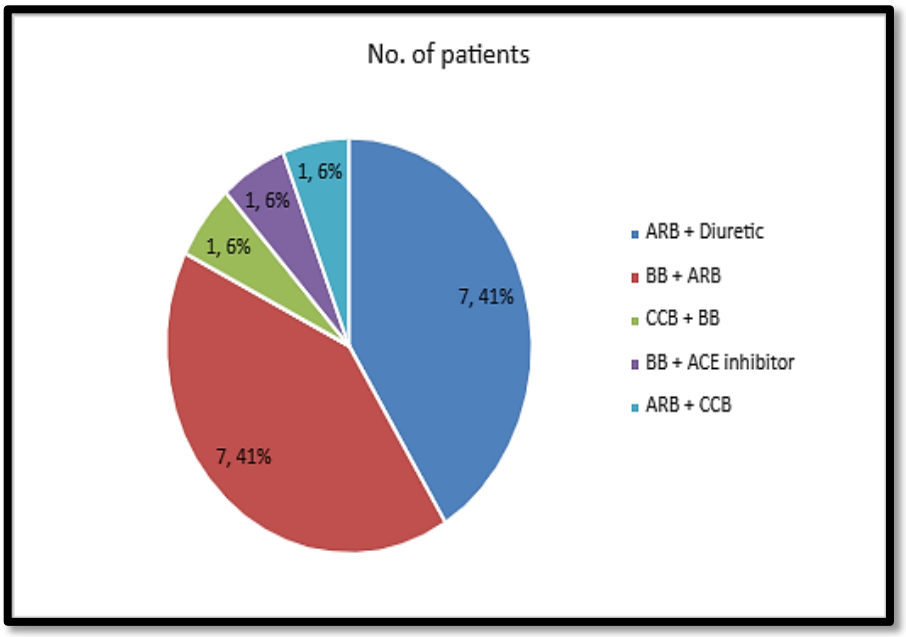
Graph 9: Percentage representation of drug classes prescribed in antihypertensive polytherapy

C) Combination therapy given for Hypertensive diabetic patients (Antihypertensives):

In fixed combination therapy, ARB + Diuretics (41%), ARB + Beta-blockers (41%) was mostly prescribed followed by CCB + Beta-blockers (6%), Beta-blockers + ACE inhibitors (6%), and ARB + CCB (6%).

Combination therapy given for Hypertensive diabetic patients (Antihypertensives)	**No. of patients**
ARB + Diuretic	7
BB + ARB	7
CCB + BB	1
BB + ACE inhibitor	1
ARB + CCB	1
TOTAL	17

Table 11: Distribution of drug classes prescribed in antihypertensive fixed combination therapy



Graph 10: Percentage representation of drug classes prescribed in antihypertensive fixed combination therapy

STATISTICAL ANALYSIS (SPSS SOFTWARE – Version 23)

- **DESCRIPTIVE ANALYSIS**

. Using SPSS software, we had conducted the descriptive Statistical Analysis for gender, type of therapy and frequencies of drug classes.

1. Gender

Male had shown greater percent (59.6%) when compared to female (40.4%) among the total population involved in the study.

Male population had shown mean of 126.05 with standard error (SE) of 5.862 followed by standard deviation 71.549 while female population had shown mean of 124.69 with standard error (SE) of 7.341 followed by standard deviation 73.777 respectively.

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	149	59.6	59.6	59.6
	Female	101	40.4	40.4	100.0
	Total	250	100.0	100.0	

Table 12: Gender frequencies

Descriptive					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
No. of patients	male	149	126.05	71.549	5.862
	female	101	124.69	73.777	7.341

Table 13: Descriptive analysis of gender

2. Type of Antihypertensive therapy

- Monotherapy was prescribed at greater percent (65.2%) when compared to polytherapy (28.0%) and fixed combination therapy (6.8) among the total population involved in the study.
- Monotherapy had shown mean of 23.29 with standard error (SE) of 8.602 followed by median 21.00, variance 517.905, std. deviation 22.758, minimum 2, maximum 57 & range 55 respectively.
- Polytherapy had shown mean of 10.00 with standard error (SE) of 3.281 followed by median 9.00, variance 75.333, std. deviation 8.679, minimum 0, maximum 21 & range 21 respectively.
- Fixed combination therapy had shown mean of 2.43 with standard error (SE) of 1.631 followed by median 1.00, variance 18.619, std. deviation 4.315, minimum 0, maximum 12 & range 12 respectively.
- Total therapy had shown mean of 35.71 with standard error of 12.963 followed by median 34.00, variance 1176.238, std. deviation 34.296, minimum 2, maximum 88 & range 86 respectively.

Type of therapy					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Monotherapy	163	65.2	65.2	65.2
	Polytherapy	70	28.0	28.0	93.2
	Combination therapy	17	6.8	6.8	100.0
	Total	250	100.0	100.0	

Table 14: Frequencies of Type of therapy (Hypertension)

Statistics					
	Age group.	No. of patients	Monotherapy	Polytherapy	Combo
Mean	4.00	35.71	23.29	10.00	2.43
Std. Error of Mean	.816	12.963	8.602	3.281	1.631
Median	4.00	34.00	21.00	9.00	1.00
Std. Deviation	2.160	34.296	22.758	8.679	4.315

Variance	4.667	1176.238	517.905	75.333	18.619
Skewness	.000	.641	.705	.150	2.413
Std. Error of Skewness	.794	.794	.794	.794	.794
Kurtosis	-1.200	-1.226	-1.287	-2.193	6.044
Std. Error of Kurtosis	1.587	1.587	1.587	1.587	1.587
Range	6	86	55	21	12
Minimum	1	2	2	0	0
Maximum	7	88	57	21	12
Sum	28	250	163	70	17

Table 15: Descriptive analysis for Type of therapy (Hypertension) Descriptive analysis of Antihypertensive monotherapy:

- In antihypertensive monotherapy, CCB's was the most prescribed drug class among other antihypertensive agents.
- CCB's had shown mean of 11.00 with standard error (SE) of 3.645 followed by median 10.00, variance 93.000, std. deviation 9.644, minimum 1, maximum 26 & range 25 respectively.
- ARBs had shown mean of 5.00 with standard error (SE) of 2.247 followed by median 5.00, variance 35.333, std. deviation 5.944, minimum 0, maximum 16 & range 16 respectively.
- Beta-blockers had shown mean of 3.71 with standard error (SE) of 1.569 followed by median 2.00, variance 17.238, std. deviation 4.152, minimum 0, maximum 11 & range 11 respectively.
- Diuretic had shown mean of 3.29 with standard error (SE) of 1.229 followed by median 3.00, variance 10.571, std. deviation 3.251, minimum 0, maximum 08 & range 08 respectively.
- Angiotensin converting enzyme inhibitors and Alpha-2 agonists had shown same mean of 0.14 with standard error (SE) of 0.143 followed by median 0.00, variance 0.143, std. deviation 0.378, minimum 0, maximum 1 & range 1 respectively.

Frequencies:

Statistics									
		Age group	No. of patients	CCB	ARB	BB	Diuretic	ACEI	Alpha2 agonist
N	Valid	163	163	163	163	163	163	163	163
Mean		4.00	23.29	11.00	5.00	3.71	3.29	.14	.14
Std. Error of Mean		.816	8.602	3.645	2.247	1.569	1.229	.143	.143
Median		4.00	21.00	10.00	5.00	2.00	3.00	.00	.00
Std. Deviation		2.160	22.758	9.644	5.944	4.152	3.251	.378	.378
Variance		4.667	517.905	93.000	35.333	17.238	10.571	.143	.143
Skewness		.000	.705	.613	1.133	1.202	.499	2.646	2.646

Std. Error of Skewness	.794	.794	.794	.794	.794	.794	.794	.794
Kurtosis	-1.200	-1.287	-1.146	.869	.038	-1.454	7.000	7.000
Std. Error of Kurtosis	1.587	1.587	1.587	1.587	1.587	1.587	1.587	1.587
Range	6	55	25	16	11	8	1	1
Minimum	1	2	1	0	0	0	0	0
Maximum	7	57	26	16	11	8	1	1
Sum	28	163	77	35	26	23	1	1
a. Multiple modes exist. The smallest value is shown								

Table 16: Descriptive analysis of drug class used in Antihypertensive monotherapy

T-TEST

The entire sample size (i.e., 250) was divided into 7 different age groups which are then organized into two different sets (i.e., < 4, >= 4).

The age groups involved in >= 4 set are group 1 (20 - 30 years), group 2 (31 - 40 years) and group 3 (41 – 50 years). The age groups involved in <4 set are group 4 (51 - 60 years), group 5 (61 - 70 years), group 6 (71 – 80 years) and group 7 (81 - 90 years).

HYPOTHESIS TESTING:

H_0 – This is known as Null Hypothesis which indicates that there is no significant difference between two set of age groups for a drug class that has been administered to treat Hypertension / Type-2 Diabetes mellitus.

H_1 – This is known as Alternate Hypothesis which indicates that there is a significant difference between two set of age groups for a drug class that has been administered to treat Hypertension / Type-2 Diabetes mellitus.

a) The cut point given to divide into 2 groups is 4.

b) < 4 - Age groups of 1 (20 - 30), 2 (31 - 40), 3 (41 - 50) were considered. Total number patients in these age groups are 48.

c) >=4 – Age groups of 4 (51 - 60), 5 (61 - 70), 6 (71 - 80), 7 (81 - 90) were considered.

1. Antihypertensive Monotherapy

Group Statistics

	Age group	N	Mean	Std. Deviation	Std. Error Mean
Diuretic	>= 4	4	4.75	3.594	1.797
	< 4	3	1.33	1.528	.882

Table 17: Group Statistics for antihypertensive monotherapy

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Diuretic	Equal variances assumed	2.433	.180	1.518	5	.189	3.417	2.251	-2.369	9.202
	Equal variances not assumed			1.707	4.249	.159	3.417	2.002	-2.015	8.848

Table 18: Independent sample test

At degrees of freedom (df) 5 & level of significance (α) 0.05 the table t-value is 2.5706. Interpretation:

The observed analysis shows no difference between the mean of 2 set of age groups for a drug class (Diuretic) that has been administered to treat Hypertension (Table 18).

The calculated t-value (1.518) is lesser than the table t-value (2.5706).

So, we have to reject alternate hypothesis and accept null hypothesis. Therefore, there is **no significant difference** between the two set of age groups for the administration of diuretics as monotherapy to treat Hypertension.

2. Antihypertensive Polytherapy

Group Statistics					
	Age group	N	Mean	Std. Deviation	Std. Error Mean
CCBBB	>= 4	4	1.50	1.915	.957
	< 4	3	.67	.577	.333

Table 19: Group statistics for antihypertensive polytherapy

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
CCB BB	Equal variances assumed	4.605	.085	.714	5	.507	.833	1.167	-2.166	3.832
	Equal variances not assumed			.822	3.690	.461	.833	1.014	-2.077	3.744

Table 20: Independent sample test

At degrees of freedom (df) 5 & level of significance (α) 0.05 the table t-value is 2.5706. Interpretation:

The observed analysis shows no difference between the mean of 2 set of age groups for a drug class (Calcium channel blocker and Beta-blocker) that has been administered as polytherapy to treat Hypertension (Table 20). The calculated t-value (0.714) is lesser than the table t-value (2.5706).

So, we have to reject alternate hypothesis and accept null hypothesis. Therefore, there is no significant difference between the two set of age groups for the administration of Calcium channel blockers (CCB) and Beta-blocker (BB) as polytherapy to treat Hypertension.

3. Antihypertensive Fixed combination therapy

Group Statistics					
	Age group	N	Mean	Std. Deviation	Std. Error Mean
ARBBB	>= 4	4	1.25	1.893	.946
	< 4	3	.67	1.155	.667

Table 21: Group statistics for antihypertensive fixed combination therapy

Independent Samples Test		
	Levene's Test for	t-test for Equality of Means

		Equality of Variances								
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ARBBB	Equal variances assumed	.581	.480	.466	5	.661	.583	1.251	-2.633	3.799
	Equal variances not assumed			.504	4.904	.636	.583	1.158	-2.410	3.577

Table 22: Independent sample test

At degrees of freedom (df) 5 & level of significance (α) 0.05 the table t-value is 2.5706. Interpretation:

The observed analysis shows no difference between the mean of 2 set of age groups for a drug class (Angiotensin receptor blocker with Beta-blocker) that has been administered as Fixed combination therapy to treat Hypertension (Table 22).

The calculated t-value (0.466) is lesser than the table t-value (2.5706).

So, we have to reject alternate hypothesis and accept null hypothesis. Therefore, there is **no significant difference** between the two set of age groups for the administration of Angiotensin receptor blocker (ARB) with Beta-blocker (BB) as Fixed combination therapy to treat Hypertension.

CONCLUSION

This study aimed at studying the current prescribing trends for antihypertensive agents among hypertensive diabetic patients. The study conducted found that majority of patients having hypertension with Type-2 Diabetes mellitus were of 61 to 70 age group followed by 51-60 age group and male patients were found to be 2/3rd than females. Monotherapy was found to be mostly preferred in antihypertensive therapy.

The analyzed data found that CCB's were most commonly prescribed antihypertensive therapy followed by Angiotensin receptor blockers (ARB's), Beta-blockers and diuretics in case of type-2 diabetic patients with hypertension. After complete analysis of the study, we found that the prescription pattern of antihypertensive classes of drugs was found to be considerately in adherence to JNC 8 guidelines for the management of hypertension. Also, the statistical analysis performed on the study data is proved as statistically significant and matches with the interpreted data.

Hence, this complete observed study brings a complete knowledge on current prescribing patterns of antihypertensive drug therapy in Hypertensive diabetic patients which further helps in improvising the patterns of drug therapy, determine better choice of drug and a knowledge to continue further clinical researches. This study also suggests the role of clinical pharmacist in better understanding of the effectiveness of a drug therapy based on DUE program in order to promote rational use of drugs and provide better clinical care.

Acknowledgments

It is our great privilege to express profound thanks and immense sense of gratitude to the rich source deep

inspiration by **DR. A. Surya Lakshmi** M.D. (Gen. Med.), MD. (Bio Chem.) Physician and Diabetologist and we also express our gratitude towards of our **management** and principal ma'am Dr**. P Uma Devi,** our senior most faculty **Dr M Savitri** ma'am**,** Vice Principal ma'am **Dr B Nagamani** of Viswanadha Institute of pharmaceutical sciences, for their timely support in providing facilities. We take this golden opportunity to express our heartfelt gratitude to **Asst. Prof. Dr. Prathyusha Behara**, Doctor of Pharmacy, for their excellent guidance, dedicated efforts, support and suggestions all the time.

Conflict of interest

Nil

Ethics committee

The institutional Ethics committee GVPIHCMT had approved for project title "Study of prescribing patterns of anti-hypertensive agents in hypertensive diabetic patients at a tertiary care hospital"

Approval Number: GVIHCMT/ICE/20221003/01

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