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Review Article

Prescription Pattern Analysis of Anti-Diabetic Drug and Anti-Hypertensive Drug with Associated Comorbidities

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ABSTRACT

The present study evaluates the prescription patterns of anti-diabetic and anti-hypertensive drugs among inpatients with comorbid conditions in a tertiary care hospital. A prospective observational design was used, enrolling 70 diabetic and 80 hypertensive patients over a six-month period. Data were collected on demographic details, clinical characteristics, and prescribed medications, and analyzed in adherence to WHO prescribing indicators. Among hypertensive patients, calcium channel blockers (CCBs), particularly amlodipine, were the most prescribed monotherapy agents, followed by angiotensin receptor blockers (ARBs) and diuretics. Combination therapy, especially ARBs with CCBs, was frequently used to address coexisting conditions such as diabetes and chronic kidney disease. Most hypertensive patients were elderly and predominantly female. In diabetic patients, metformin emerged as the most commonly prescribed drug, both alone and in combinations with glimepiride, pioglitazone, and newer agents like vidagliptin and dapagliflozin, reflecting a blend of traditional and modern pharmacological approaches. Despite combination regimens, only 41% of patients achieved optimal glycemic control. Antibiotic co-prescription was observed in 34% of diabetic cases, with azithromycin and cephalosporins being the most common. WHO prescribing indicator analysis revealed rational drug use in terms of polypharmacy and injectable prescriptions; however, areas needing improvement include generic prescribing (85% vs. ideal 100%) and appropriate antibiotic utilization. This study underscores the need for continual prescription audits, adherence to evidence-based guidelines, and personalized treatment strategies to improve therapeutic outcomes in patients with diabetes, hypertension, and associated comorbidities.

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INTRODUCTION

HYPERTENSION

DEFINITION:

Although it is not a disease in and of itself, hypertension is a frequent condition, especially beyond middle age, and it is a significant risk factor for cardiovascular disease and death. Blood pressure above 140 mm Hg systolic and 90 mm Hg diastolic is referred to as hypertension.[1] According to Eight report of joint national committee on the Detection Evaluation and treatment of high blood pressure hypertension has 4 stages and it is illustrated as follows, [2]

Table No: 1 JNC VIII classification of Hypertension

BLOOD PRESSURE	SYSTOLIC	DIASTOLIC
Normal	>120	<80
Prehypertension	120-139	80-89
Stage1	140-159	90-99
Stage2	≥160	≥100

Your blood pressure is the force of blood against the walls of your arteries. Your heart pumps blood to different parts of your body through vessels. Blood pressure naturally rises and falls during the day, but if it remains high for a long period of time, it can damage your heart and cause other health problems. Hypertension, or high blood pressure, is the term used to describe blood pressure that is higher than usual. [3] Hypertension is often referred to as the silent killer. Although symptoms are usually absent, persistently elevated blood pressure is a common cause of premature mortality. Over time, it harms multiple organs and can result in stroke, chronic renal failure, and overt cardiovascular disease. It is the second most common cause of CKD, or chronic kidney disease. An estimated 1.28 billion people between the ages of 30 and 79 have hypertension worldwide; two-thirds of these people live in low- and middle-income countries. [4]

MEDICATION FOR HYPERTENSION

It is well recognized that cardiovascular disease is associated with obesity, diabetes, hyperlipidemia, or the metabolic syndrome, all of which coexist with hypertension. The identification and management of these risk factors is a crucial part of the overall care of people with hypertension. Because patients in these specific groups are more prone to suffer from target organ damage (TOD), clinical recommendations have set stringent goals for blood pressure (BP) regulation.[5]

CO MORBIDITIES OF HYPERTENSIVE PATIENTS:

Comorbidities can have a big influence on how hypertension is managed. In order to enhance overall health outcomes, treatment techniques frequently need to target many illnesses at once. For instance, to treat obesity, diabetes, and hypertension all at once, medication may be advised in addition to lifestyle changes like food and exercise. [6,8]

EPIDEMIOLOGY:

The rising prevalence of hypertension has been attributed to a number of variables, including aging populations, growing populations, and behavioral risk factors such as poor diet, excessive alcohol use, sedentary lifestyles, obesity, and long-term stress. Every year, hypertension claims the lives of an incredible 9.4 million people globally.The global death rate from CVD dropped from 354.5 deaths per 100,000 people in 1990 to 239.9 deaths per 100,000 people in 2019. High-income countries saw the fastest decline in the death rate, albeit this decline was not consistent across all regions [7], Epidemiological studies show

that the incidence of hypertension in India is rapidly increasing, with rates ranging from 4 to 15% in urban regions and 2 to 8% in rural areas.The numerous guidelines created worldwide for the treatment of hypertension serve as standards for clinical practitioners.[8] Nine percent of participants in an integrated illness surveillance initiative in Tamil Nadu had a medical expert diagnose them with hypertension. 10% of the population had hypertension, with 9% of men and 11% of women affected. 8% of hypertensive individuals reside in rural areas.[9]

SYMPTOMS OF HYPERTENSION:

High blood pressure, also referred to as hypertension, is the result of an overly high force of blood against the walls of arteries. This condition can lead to serious health issues such as heart disease or stroke. It grows slowly, often without any symptoms, even at extreme amounts. Constricted arteries and rising blood volume are two of the things that raise blood pressure. Some may experience severe spells of headaches, nosebleeds, or shortness of breath, but the majority do not exhibit any symptoms. Thankfully, it is easy to detect and treat with medical help. Regular care and monitoring can prevent long-term injury.

DIABETES

Diabetes mellitus (DM) is a metabolic disorder that can result from a defect in the action, secretion, or both of insulin. Insulin deficiency leads to chronic hyperglycemia and anomalies in the metabolism of proteins, lipids, and carbohydrates. It is the most common endocrine condition. As diabetes progresses, tissue or vascular damage occurs, leading to major complications such as ulceration, retinopathy, neuropathy, nephropathy, and cardiovascular issues. Therefore, diabetes includes a wide range of different conditions. (10)

Types of diabetes:

1. **Type 1 Diabetes mellitus:** In type-1 diabetes, formerly referred to as "juvenile onset diabetes" or "insulin dependent diabetes mellitus," the body is unable to manufacture insulin. The vital hormone insulin is produced by the pancreas, a gland located near the stomach. The primary energy source for the body, glucose, needs to be transformed into energy. In the absence of insulin, glucose stays in the blood. Excess hyperglycemia can damage the blood vessels supplying the kidney, bladder, and eyes if it is not controlled. Insulin is used everyday by people with type 1 diabetes to regulate their blood sugar levels and prevent this harm. Type 1 diabetes usually affects youngsters or people under 30 years old, while it can occur at any age.(11)

2. **Type 2 Diabetes mellitus:** Type 2 diabetes, formerly referred to as "adult-onset diabetes" or "non-insulin dependent," is the most common form of the condition. Over time, type 2 diabetes develops when the pancreas is unable to produce enough insulin. Similar to type 1 diabetes, glucose stays in the bloodstream and cannot be transformed into energy. During this period, the pancreas produces more insulin to overcome the resistance. The extra insulin helps cells absorb enough glucose to keep blood glucose levels from rising. Months or years may pass with no discernible symptoms(12)

3. **Gestational Diabetes:** Gestational diabetes occurs when a pregnant woman's body cannot produce enough insulin. There are typically no symptoms. Pregnant women should get tested for diabetes between weeks 24 and 28. Women who are already at risk for diabetes should be evaluated during their initial

prenatal checkup. Most women need two to three times as much insulin during pregnancy because of normal hormonal changes [13]

PATHOPHYSIOLOGY OF DIABETES MELLITUS:

TYPE 1 DIABETES

The autoimmune loss of pancreatic β-cells results in a shortage of insulin synthesis, which leads to the metabolic abnormalities associated with type 1 diabetes. T1DM patients exhibit increased glucagon secretion, abnormal pancreatic α-cell activity, and reduced insulin synthesis. Hyperglycemia typically reduces glucagon secretion; however, in individuals with type 1 diabetes, hyperglycemia has no effect on glucagon secretion. The resulting excessively high glucagon levels exacerbate the metabolic problems caused by insulin deficiency. Insulin insufficiency is the primary problem with type 1 diabetes, but there is also a problem with the way insulin is given.Lack of insulin prevents peripheral tissues like skeletal muscle from metabolizing glucose by causing uncontrolled lipolysis and elevated plasma levels of free fatty acids. Additionally, glucokinase in the liver and the GLUT 4 class of glucose transporters in adipose tissue are among the genes whose expression is decreased by insulin shortage and are necessary for target tissues to react to insulin appropriately. These elements clarify why the primary metabolic problems resulting from insulin shortage in type 1 diabetes are poor glucose, lipid, and protein metabolism.

TYPE 2 DIABETES

These processes malfunction in type 2 diabetes, leading to the two primary pathophysiological abnormalities: decreased insulin secretion due to pancreatic β-cell dysfunction and decreased insulin action due to insulin resistance. The mass of β-cells changes in circumstances when insulin resistance is predominant, which can boost the insulin supply and make up for the high and unusual demand. Although the plasma insulin concentration (both fasting and meal-stimulated) is often elevated in absolute terms, it is insufficient to sustain normal glucose homeostasis "relative" to the degree of insulin resistance. Given the close connection between insulin secretion and hormone action sensitivity in the intricate regulation of glucose homeostasis, it is nearly impossible to distinguish the roles played by each in the etiopathogenesis of DM2.Impaired glucose tolerance is ultimately caused by insulin resistance and hyperinsulinemia. The method of inheritance for type 2 diabetes mellitus is uncertain, with the exception of maturity onset diabetes of the young (MODY). Mutations in the glucokinase gene on chromosome 7p may cause MODY, an autosomal dominant trait. When islet cell antibodies (ICA) are negative, MODY is defined as hyperglycemia detected before the age of 25 that can be managed without insulin for more than five years.

COMPLICATIONS IN DIABETES MELLITUS:

Retinal vascular disease: Diabetic retinal degeneration, a capillary disorder that can impact the macula, peripheral retina, or both, is one of the primary causes of blindness and visual loss in diabetics. Complete or significant visual loss may result from vitreous hemorrhage or retinal objectivity. It can be divided into two groups under the previous arrangement: "benign diabetic retina" (NPDR) and "expanding diabetic retina" (PDR). The primary features of NPDR include increased microaneurysm and liquid leakage, capillary divider insufficiency, and more prominent leukocyte and monocyte endothelial adhesion. Diabetic retinopathy is characterized by endothelial cell and pericyte retinal capillary

degeneration caused by the prevalence of ischemia and microaneurysm.[14]

Neuropathy: Diabetic polyneuropathy is the most common kind of neuropathy and one of the most common long-term effects of diabetes in the developed world. Among the various neuropathic conditions it encompasses, diabetic peripheral neuropathy (DPN), also known as chronic distal symmetrical polyneuropathy, is the most common. DPN is associated with an increased risk of death and cardiovascular disease. Significant morbidity is also brought on by it, including amputations, foot ulcers, and neuropathic pain. Risk factors for DPN include poor glucose management and markers of macrovascular disease, such as hypertension. There is now strong evidence that nerve ischemia is the reason. Painful DPN affects 15–26% of diabetics and can seriously impact their quality of life[15]

Nephropathy: Diabetic nephropathy affects around 40% of adults with type 1 and type 2 diabetes and is the most common cause of kidney damage among those starting renal replacement therapy. It is characterized by elevated urine albumin discharge in the absence of other renal disorders, increases the risk of death, and primarily results from cardiovascular reasons. Microalbuminuria (UAE >20 μg/min and ≤199 μg/min) and macroalbuminuria (UAE ≥200 μg/min) are the two stages of diabetic nephropathy. The three main risk factors for the development of diabetic nephropathy are hyperglycemia, high blood pressure, and genetic susceptibility. Additionally, smoking, high blood cholesterol, and the type and amount of protein taken seem to be risk factors. Annual screening for type 1 diabetes must start five years after the diagnosis, or earlier if puberty had already occurred. High blood cholesterol, smoking, and the amount and type of protein consumed in the diet all appear to be risk factors. Type 1 diabetes should be monitored annually for about five years following diagnosis, or sooner if puberty or poor metabolic control are noticeable. After receiving a type 2 diabetes diagnosis, people should be checked often after that. It is critical to check for the presence of related conditions, particularly retinopathy and macrovascular disease, in individuals with both micro- and macroalbuminuria.[16]

Cerebrovascular diseases: Cerebrovascular disease is the main cause of diabetes-related illness and mortality. Individuals with diabetes have a lower functional outcome, an earlier onset of symptoms, and a stroke risk that is at least double that of those without the condition. About 20% of people with diabetes die from stroke, making it one of the leading causes of death in this population. Effective primary and secondary stroke prevention strategies have been developed from research cohorts that include individuals with and without diabetes. However, when it comes to preventing diabetes, there are a few specific aspects to consider. In this article, we have collated the data to aid in the diagnosis and treatment of stroke in people with diabetes [17]

DIAGNOSIS: Those who are at risk (so that lifestyle changes and other preventative measures can be implemented) and those who have early disease (so that treatment can begin) can be identified through early identification and monitoring. A glycated hemoglobin level of 6.5% or higher, or a fasting plasma glucose level of 126 mg per deciliter (7.0 mmol per liter) or higher, is the diagnostic cutoff point for diabetes; the diagnosis needs to be verified by the same test or another one. The American Diabetes Association recommends a range of 5.7 to 6.4% for glycated hemoglobin levels that are diagnostic of prediabetes, while there is disagreement over this

range. Prediabetes is defined as a fasting glucose level between 100 and 125 mg/dL (5.6 and 6.9 mmol/L). For certain ambient glucose levels, there have been reports of racial and ethnic differences in glycated hemoglobin levels; hemoglobinopathies and conditions involving reduced red-cell turnover can result in inaccurate glycated hemoglobin readings. Both glycated hemoglobin and fasting plasma glucose tests identify patients at similar risk for adverse outcomes, although they appear to identify different patient groups with prediabetes and diabetes [18]

Table No: 2 Drug Classifications: [19]

CLASSIFICATION OF ANTI-DIABETIC DRUGS	AGENTS	ROUTE OF ADMINIS-TRATION	MECHANISM OF ACTION	Adverse effects
Biguanide	Metformin	Oral	Sensitizer to insulin Several impacts on hepatic glucose production inhibition	Anemia and neuropathy can result from a vitamin B12 deficiency (risk in elderly) Very safe medication; nevertheless, if a person's Men's and women's creatinine concentrations vary more than 1.5 and 1.4 mg/dL, accordingly. , discontinue taking metformin.
Dipeptidyl peptidase 4 [DPP-IV] inhibitor	Sitagliptin Saxagliptin Vidagliptin Alogliptin Linagliptin	Oral	Prevention of GLP mortification	URTI, Pancreatits.
Sodium glucose Cotransporter [SGLT2] inhibitor	Canagliflozin Dapagliflozin Empagliflozin	Oral	Presence of glucose level in urine brought on by renal PCT's 90% blockage of glucose reabsorption; insulin-independent mode of action	Ketoacidosis, Bone fractures, Genital mycosis.
Insulin	Humulin R Novolin R Levemir Tresiba Lispro Aspart Apidra	Parental	Insulin receptor activation and subsequent signaling in several delicate tissues	Lipohypertrophy and lipoatrophy at locations of injection Intolerance to injection ingredients For gestational diabetes mellitus, the Levemir Food and Drug Administration has granted approval.
GLP 1 agonist	Liraglutide Exenatide Dulaglutide	Parental	Turn on the GLP1 receptor Reduced glucagon, delayed stomach	Pancreatitis, nausea, vomiting, and thyroid C cell tumors (which are

			emptying, elevated satiety, and increased insulin secretion	contraindicated in MEN type 2)

REVIEW OF LITERATURE

Pankaj Kumar Jain et al, The purpose of the study is to ascertain the trend of antihypertensive medication prescriptions among a group of patients at a tertiary care facility in the East Nimar region of Central India. A total of 86 patients' clinical and demographic information was gathered, and the prescriptions of these hypertensive patients were examined. The largest proportion of hypertensive patients (of the 86 total patients), both male and female, were between the ages of 60 and 70. Amlodipine and calcium channel blockers were the most prescribed drug classes since the majority of patients were older, followed by metoprolol and telmisartan. Of the 35 patients (40.69%) who received combination therapy, 25 patients (20.06%) frequently received two drug combinations. With 16 patients (18.60%), ARBs + CCBs dominated the scenario. This was followed by CCBs + Beta Blockers (5 patients, 5.81%). Our results demonstrated that among older individuals with hypertension, CCBs dominated the monotherapy scenario, followed by CCB and ARB combination therapy. Since the majority of patients were elderly, the use of antihypertensive medications generally complies with the guidelines; nonetheless, there is still much space for improvement in terms of sensible prescribing.[20]

Bipin panda et al , Behavior The purpose of the study was to determine the trend in anti-hypertensive medication prescriptions among hypertensives and diabetic hypertensives in Odisha. A two-month prospective study was carried out at Sambalpur's Veer Surendra Sai Medical College and Hospital. Prescriptions for antihypertensives were gathered from patients who were seen in the general medicine outpatient department. Of the 422 prescriptions that were tracked, 285 were written by men and 137 by women. The patients' ages range from 35 to 75 years old. Of the 422 prescriptions, 304 were for diabetic hypertensives and 118 were for hypertensives. Antihypertensive medication combinations were used to treat 48% of hypertensive patients, while single antihypertensive medications were used to treat 52% of patients. Just 17% of people have secondary hypertension (HTN), compared to 83% who have primary hypertension (HTN). Both combination therapy and monotherapy were used to treat hypertension. Primary hypertension (HTN) affects 83% of persons, while secondary hypertension (HTN) affects just 17%. Hypertension was treated with both solo and combination medication.[21]

Tom Cyril et al, Investigate how antihypertensive medications are prescribed and evaluate the risk factors linked to hypertension. Males over 60 years old were the most impacted by hypertension out of the 31 cases. According to the JNC 7 classification, the majority of study participants (41.9%) had Stage II hypertension. Age was the primary risk factor for hypertension (41.9%), followed by drunkenness (12.9%) based on environmental risk factors and diabetes (64.5%) based on disease. According to the study, Type II DM was comorbid in the majority of patients, or 19 (61.3%), with CKD, followed by 15 (48.4%). The majority of patients, or 74.2%, received triple therapy, while 25.8% received monotherapy. Furosemide (diuretics) 18 was the most often given medication (58.1%).[22]

Taklo Simeneh Yazie et al, Examining prescription trends for hypertension and blood pressure (BP) control at randomly chosen South Gondar Zone hospitals was the aim of the current study. Data analysis includes all 423 patients who were recruited. On average, 93.5% of prescriptions for hypertension were found to comply with WHO guidelines. Monotherapies accounted for almost 53% of prescriptions for hypertension. Diuretics were the most frequently prescribed drug in monotherapy and in combination with calcium channel blockers (CCBs) as dual therapy. On average, more than 90% of prescription was in accordance with WHO guideline and around one-third of participants experienced at least one moderate or major drug-drug interaction. Monotherapy and patient-level low medication regimen complexity were favorably correlated with blood pressure control, but non-adherence, poor drug selection[23]

Dinesh Prasad Sinha et al, Behavior The purpose of the study was to examine the present practice of prescribing antihypertensive medications in an Indian tertiary care hospital. Prescriptions written for patients with essential hypertension who visited the outpatient department of Patna Medical College in Patna, Bihar, between December 2023 and March 2024 were examined cross-sectionally. A total of 1000 prescriptions for hypertensive patients were gathered over the course of the trial; 500 of these were disqualified based on the exclusion criteria. Uncomplicated hypertension affected the remaining 500 people (62.07% of whom were men and 39.29% of whom were women). This study offers baseline data and depicts the current prescribing trends for antihypertensive medications.For comparable research in the future, given the constantly shifting trends in the prescription of antihypertensive medications.[24]

Supriya Selvakumar Suseela et al, A tertiary care hospital's prescribing practices for hypertension patients will be evaluated through a research based on JNC 8 standards. All patients gave their informed consent after 100 hypertensive prescriptions were screened for the trial. The selection of antihypertensive medications complies with the JNC 8 criteria for the management of hypertension in a reasonable manner, indicating that practitioners are generally in conformity with the standards. According to this study, diuretics are the first-choice medication for hypertension in monotherapy, triple treatment, and quadruple therapy. The majority of patients with a hypertensive diagnosis were men. To raise the BP control rate in this institution, however, better patient education regarding medication adherence and more focus from physicians on lifestyle modification issues are required.[25]

Dinesh Prasad Sinha et al, Finding out how anti-diabetic drugs are now prescribed and how well they maintain proper glycemic control in diabetic patients receiving treatment at a teaching hospital in Patna, Bihar, was the aim of this study. This cross-sessional, prospective, observational study was conducted with 150 patients in accordance with the World Health Organization's handbook to assess drug use in specific facilities. wherein 100 (n = 150) patients with Type 2 diabetes were evaluated and 140 anti-diabetic prescription items were prescribed. With 54% of participants being male (n = 81) and 46% being female (n = 69), the sample's mean age was 58.12 (±10.5) years. Of the 140 anti-diabetic drug items prescribed, 84 (56.4%) and 66 (43.6%) were OHA and insulin, respectively. OHAs were therefore the most frequently suggested class of anti-diabetic drugs in our investigation. The most often prescribed class of OHA was sulfonylureas (35.14%), followed by biguanides (32.65%), and their fixed dose combination (FDC) accounted for 21.25%. The

most often administered individual OHA was biguanide, also known as metformin (32.6%), followed by glimepiride (sulfonylurea) (21.25%) and the FDC of glimepiride and metformin (12.40%). The data indicates that OHAs continue to dominate the prescribing pattern, even in the face of a shift toward the use of insulin preparations in the treatment of Type 2 diabetes mellitus. Since anti-diabetic drugs were only 41% successful in preserving appropriate glycemic control, it is necessary to strengthen current drug treatment and develop multiple drug interventions with lifestyle changes.[26]

Mohd Mahmood et al, The main objective of this study was to highlight current prescribing practices for people with diabetes mellitus who also have other co-morbid conditions. A prospective observational study was conducted on inpatients admitted to various wards in a tertiary care hospital over a six-month period, from October 2016 to March 2017. A carefully designed questionnaire is used to collect prescriptions from patients, and relevant information is recorded and reviewed. The study looked at the prescription habits of 235 patients, 62.97% of whom were men and 37.02% of whom were women. Patients between the ages of 41 and 60 made up the majority. Hypertension was the most common co-morbid condition. Rapid-acting insulin was typically prescribed while the patient was hospitalized. Metformin was the most often prescribed oral hypoglycemic drug, followed by glimepride. Adverse drug reactions can be decreased by replacing current medications with new ones, such as glucagon-like peptide agonists, dipeptidyl peptidase inhibitors, and sodium-glucose transport inhibitors. Medication interactions should be managed using clinical significance and correlation.[27]

P. Bhavana et al, Research on drug use helps identify clinical drug usage in the public and its impact on the healthcare system, as well as evaluate rational drug use. to look into prescription trends and evaluate treatment compliance in diabetes patients who come to the medical outpatient department of a teaching hospital. Drug consumption research helps identify clinical drug use in the population and its impact on the healthcare system. must decide to give some drugs to people with diabetes mellitus primarily through the cautious use of medications. Patients with diabetes in the General Medicine Department took part in a cross-sectional retrospective study for six months. Data from 280 patients were collected and analyzed. In all, 280 patients with diabetes mellitus were admitted. In our analysis, polypharmacy was found in almost all of the prescriptions. Insulin was the most often prescribed drug for diabetes mellitus (22.14%), followed by metformin (8.21%) and glimepiride (16.78%). Sulfonylureas are used in monotherapy in 50.7% of cases, two-drug combinations in 21%, and three-drug combinations in 2.14% of cases. Of the patients, 45.71% were female and 54.28% were male; 44.41% were prescribed combination therapy and 52.48% were prescribed monotherapy. Insulin and glimepiride are the most often prescribed medications; however, they must be assessed using the proper criteria before being prescribed to patients. To put it another way, strict commitment to responsible drug use is necessary.[28]

Temesgen Sidamo Summoro et al, Rational prescribing is one of the first steps in ensuring responsible drug use. Inappropriate prescriptions for half of the drugs are common, and because people don't take them as recommended, half of them are even abused. The purpose of this study was to investigate the drug-prescribing procedures of four hospitals in southern Ethiopia. Using

World Health Organization (WHO) prescribing indicators, a retrospective cross-sectional study was conducted from May 15 to June 25, 2014, to evaluate drug-prescribing trends. The four hospitals' outpatient departments' prescription records from the previous year were reviewed in compliance with WHO guidelines. Additionally, a review of hospital prescriptions revealed the most often prescribed drugs. All statistical analyses were performed using SPSS® version 20.0. The average number of drugs per prescription varied from 1.82±0.90 to 2.28±0.90, while the rates of use for injectables and antibiotics ranged from 15 to 61.7 and 46.7 to 85, respectively. The essential medicines list and generic names accounted for 94.1 and 95.8, respectively, of the average percentages of prescription medications. Analgesics and anti-infectives are the drugs that are most frequently administered. The prescribing practices deviated somewhat from the WHO's guidelines for permissible polypharmacy. Prescriptions from the essential medicine list and under generic names were almost perfect. In the other two hospitals, however, injectables were used within the allowed range.[29]

Akshay A. Agarwal et al, Examining how anti-diabetic drugs are provided and how well they maintain optimal glycemic levels in diabetic patients receiving treatment at a tertiary care teaching hospital in Navi Mumbai was the aim of the study. To assess their prescription habits for anti-diabetic medications, one hundred patients with diabetes mellitus who were examined in the diabetes outpatient and medicine outpatient departments took part in a prospective, cross-sectional, observational study. To evaluate the patients' glycemic management, blood glucose levels were measured using the Accu-Chek Active glucometer. During the trial, 1.4 anti-diabetic drugs were prescribed on average, with one to four anti-diabetic pharmaceutical items prescribed. Out of the 140 anti-diabetic drugs prescribed, 61 (43.6%) were insulin and 79 (56.4%) were OHA. Accordingly, in our analysis, OHAs were the most frequently suggested class of anti-diabetic drugs. Sulfonylureas (34.14%) and biguanides (31.6%) were the most frequently prescribed classes of OHA, with their fixed dose combination (FDC) accounting for 20.25%. Metformin (biguanide) was the most frequently prescribed individual OHA. Glimepiride (sulfonylurea) came in second at 20.25%, while the FDC of glimepiride and metformin was 11.40%. Alpha glucosidase inhibitors (3.8%), thiazolidinediones (6.33%), and dipeptidyl peptidase 4 inhibitors (DPP 4 inhibitors) were among the other OHA classes that were assigned. The most often used kind of insulin preparation, accounting for 43.6% of all anti-diabetic drugs, was short-acting insulin preparation.[30]

Asha Pathak et al, To urge patients in rural areas to take pharmaceuticals responsibly, it is essential to assess drug usage patterns using WHO prescription indicators. Evaluating drug prescription patterns among patients hospitalized to the Medicine department at UPRIMS&R was the aim of this study. A prospective observational study was conducted from January to June 2015. The data was collected, analyzed, and presented using descriptive statistics in compliance with WHO prescription indicators. A total of 626 prescriptions were selected, of which 3205 were written. 24.64% of all prescriptions were for antibiotics, with the next most common categories being anti-diabetic drugs (12.38%), analgesics (12.23%), cardiovascular drugs (11.82%), and GIT drugs (9.01%). On average, 5.11 medicines were prescribed.[31]

AIM:

To study prescription pattern, to evaluate the adherence to treatment guidelines in diabetic and

Antihypertensive patients attending the medical In patient department in a tertiary care teaching hospital.

OBJECTIVE:

- To examine demographic information of the enrolled patients.
- To describe the patterns of use of major pharmaceutical drug classes given for diabetes and Hypertensive
- To know about the current use of Anti-Diabetics drug And Anti-Hypertensive Drug
- To examine the prescriptions with polypharmacy.
- To evaluate the glycemic control patients receiving different treatment regimens

METHODOLOGY

Sample size:

Diabetes Patients

The sample size is calculated using the Rao soft online sample size calculator. For a random sampling of a population of 200 persons with a confidence interval of 95%, the sample size is found to be 70 with a 5% margin of error. The following formula is used to calculate the size of the required sample $N= Z^2 x p (1- p)/ d^2$

Where; N= sample size
Z= reliability co-efficient with 95% confidence level =1.96
P= population variance available from previous data = 0.089
D= degree of precision or margin of error = 0.05
$N = (1.96)^2 x 0.058 (1- 0.089) / (0.05)^2$
N = 70
SAMPLE SIZE (n) = 70patients.

Hypertensive Patients

The sample size is calculated using the Rao soft online sample size calculator. For a random sampling of a population of 100 persons with a confidence interval of 95%, the sample size is found to be 80 with a 5% margin of error. The following formula is used to calculate the size of the required sample $N= Z^2 x p (1- p)/ d^2$

Where; N= sample size
Z= reliability co-efficient with 95% confidence level =1.96 P= population variance available from previous data = 0.058
D= degree of precision or margin of error = 0.05
$N = (1.96)^2 x 0.058 (1- 0.058) / (0.05)^2$
N = 80

SAMPLE SIZE (n) = 80 patients. Study design: A prospective observational study is conducted in the inpatients admitted to various words.

Study duration: Six months

STUDY SITE: St Isabel Hospital, Mylapore, Chennai-600004

Source of data:

All relevant and necessary data for the study was collected from the patients profile forms and from the patients medication chart.

Study procedure:

The study teams visits the study site on a regular basis and selects the patients according to the study criteria, the necessary data is collected from the patient in the patient profile form and the medication chart in a designed data collection form.

Data collection instrument:

To collect data, I used data collection form. The observational study includes the following informations.

SECTION:1

- Demographical Data:
- Gender, Age

SECTION:2

- Investigations:
- Range of HbA1c levels in patients and blood glucose level.

SECTION:3

- Prescription pattern of anti-diabetics drug:
- Oral hypoglycemic therapy, insulin and combinations per prescription

SECTION:4

- Prescription pattern of anti-hypertensive drug:
- Clinical Characteristics of Hypertensive Patients, Drugs of Monotherapy, Two Drug Combinations, Three Drug Combinations.

WHO PRESCRIBIMG GUIDELINES:

1. **Average number of medications per counter:** This figure is determined by dividing the total number of prescriptions for various drug items by the number of encounters that were survived. Whether the patient actually received the medications is irrelevant.

2. **Prescription medication percentage by generic name:** This percentage is determined by dividing the number of prescription pharmaceuticals prescribed by generic name by the total number of prescription drugs, then multiplying the result by 100.

3. **The proportion of interactions where an antibiotic is prescribed:** Divide the number of patient interactions during which an antibiotic is provided by the total number of encounters survived, then multiply the result by 100 to get the percentage.

4. **The proportion of interactions where an injection is prescribed:** The percentage is determined by dividing the number of patients seen during an injection visit by the total number of encounters that were survived, then multiplying the result by 100.

5. **Percentage of medications prescribed from the formulary's list of essential drugs:** The percentage is determined by dividing the number of prescribed goods that are either on the local formulary or the essential medications list (or that are identical to pharmaceuticals on the list).

RESULTS

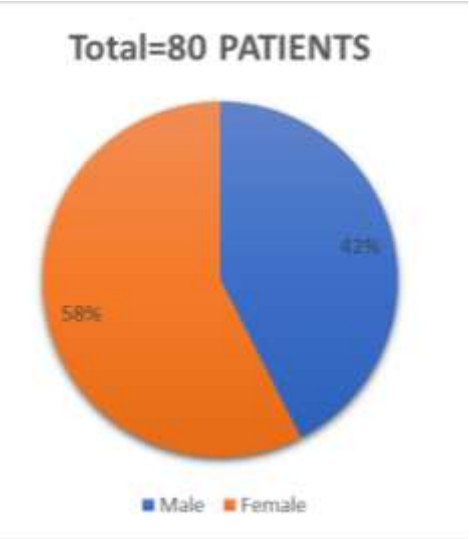

Fig1.Sex wise distribution of Hypertensive Patients

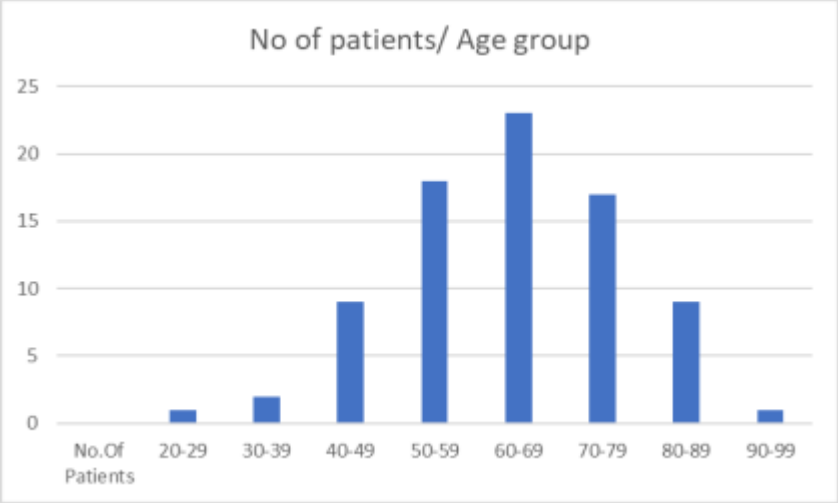

Fig.2 Age wise Distribution of Hypertensive Patients:

Tabe No: 3. Clinical Characteristics of Hypertensive Patients

No of comorbidity	No of patients with comorbid conditions	Percentage	95% Confidence Interval
No comorbidity	21	26.21%	0.1663 to 0.3587
One comorbidity	25	31.25%	0.2110 to 0.4140
Two comorbidity	27	33.75%	0.2340 to 0.4410
Three Comorbidity	7	8.75%	0.0255 to 0.1495
Types of Comorbidities			
Diabetes Mellitus	9	11.25%	0.0433 to 0.1817
Hypothyroidism	3	3.75%	0.0000 to 0.0791
Diabetes mellitus + Hypothyroidism	1	1.25%	0.0000 to 0.0368
Chronic Kidney Disease	4	5.00%	0.0022 to 0.0978
Diabetes mellitus + chronic kidney disease	5	6.25%	0.0095 to 0.1155
Diabetes mellitus + chronic kidney disease + Hypothyroidism	2	2.50%	0.0000 to 0.0592
Coronary Artery Disease	2	2.50%	0.0000 to 0.0592

Table No: 4 Prescription pattern of Anti-Hypertensive Drugs:

Anti-Hypertensive Drug Class	Number of Prescriptions	Percentage of Prescriptions	95 % Confidence interval
Drugs of Monotherapy	46	57.50	0.4616 to 0.6836
Diuretics	10	12.50	0.0540 to 0.1960
Angiotensin Converting Enzyme Inhibitors	0	0.00	0.0000 to 0.0460
Angiotensin Receptor Blockers	12	15.00	0.0740 to 0.2260
Beta Blockers	6	7.50	0.0160 to 0.1340
Calcium Channel Blockers	16	20.00	0.1111 to 0.2890
Other Antihypertensive	2	2.50	0.0000 to 0.0600
Two Drug Combinations	21	26.25	0.1665 to 0.3589
ARBs+ Diuretics	3	3.75	0.0000 to0.0850
ARBs + CCBs	11	13.75	0.0627 to 0.2123
ARBs + Beta Blockers	2	2.50	0.0000 to 0.0600
CCBs + Beta Blockers	3	3.75	0.0000 to 0.0850

ARNI+ARB	2	2.50	0.0000 to 0.0600
Three Drug Combinations	9	11.25	0.0530 to 0.2020
ARBs + CCBs + Beta Blockers	2	2.50	0.0000 to 0.0600
ARBs + CCBs + Diuretics	5	6.25	0.0090 to 0.1160
ARB +CCBs+ Central agonist	2	2.50	0.0000 to 0.0600
ACE Is +CCBs+ Diuretics	0	0.00	0.0000 to 0.0460
Four Drug Combinations	5	6.25	0.0090 to 0.1160
ARBs + CCBs + Beta Blockers + Diuretics	5	6.25	0.0090 to 0.1160

Out of Total 80 Patients, the maximum percentage of Hypertensive patients, including both males and females belonged to the age group of 60 to 70 years. Among the total 80 patients, 34 were male patients and 46 patients were females. As majority of Patients belonged to the elderly age group, Calcium channel Blocker /Amlodipine was the most prescribed drug class/ drug, followed by Telmisartan and Torsemide. Out of total 80 Prescriptions, 46 Prescriptions (57.5%) composed of Monotherapy and a total of 16 Prescriptions (20.00%) among these were of Calcium Channel blockers. Angiotensin receptor blocker comprised of 12 Prescriptions (15.00%), diuretics comprised of 10 Prescriptions (12.50%) and Beta blockers were prescribed among 6 patients (7.50%).Other hypertensive drugs also 2 prescribed (2.50%). Among the combination therapy prescribed in 34 patients (40.69%), often two drug combination were prescribed (21 patients, 26.25%), ARBs Combination with CCBs dominated the scenario with 11 patients (13.75%) followed by CCBs + Beta Blockers (3 patients, 3.75%). As far as comorbid conditions are concerned 33 Patients the majority (33.75%) had two comorbid conditions, followed by 31.25% with one comorbidity and 26.21% with no comorbidities. The most common individual comorbidity was Diabetes Mellitus (11.25%), followed by Chronic Kidney Disease and its combinations. Only 8.75% of patients presented with three comorbid conditions, indicating a relatively small but significant group with complex health issues.

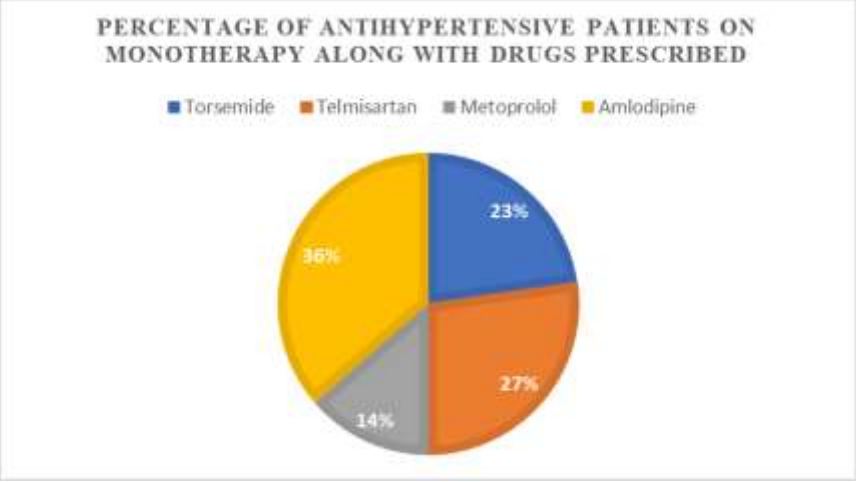

Fig :3 Percentage of Antihypertensive patient Mono-therapy along with drugs prescribed

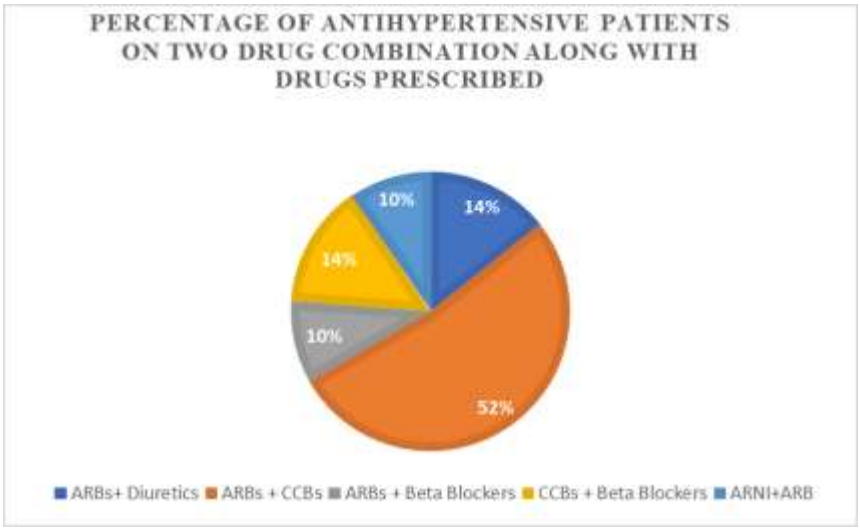

Fig :4 Percentage of Antihypertensive patient Two Drug Combination along with drugs prescribed

RESULTS FOR DIABETES

This study was conducted with 80 diabetic patients, under which 66% of them are male and 34% of them are female.

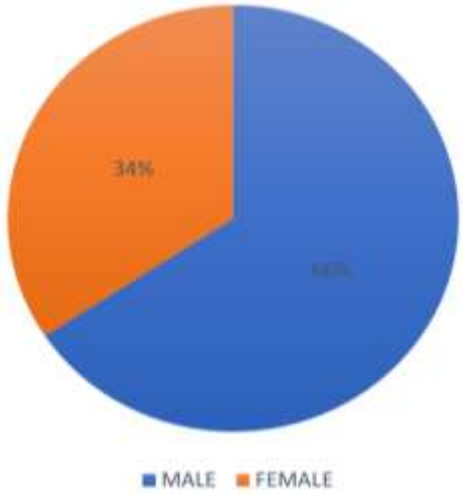

Fig: 5 Sex wise distribution of diabetes patients

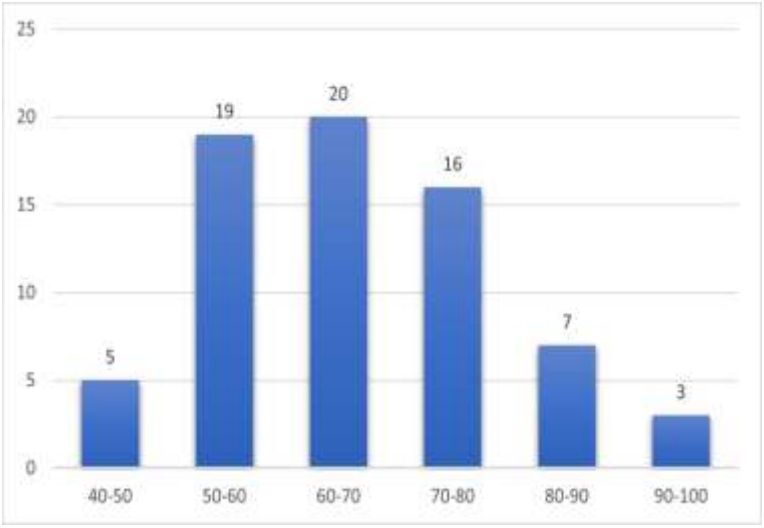

Fig: 6 Age wise distribution of diabetes patients

In this study, 5 patients were in the 40-50 age group, 19 were in the 50-60 age group, 20 were in the 60-70 age group, 16 were in the 70-80 age group, 7 were in the 80-90 age group, and 3 were in the 90-100 age group.

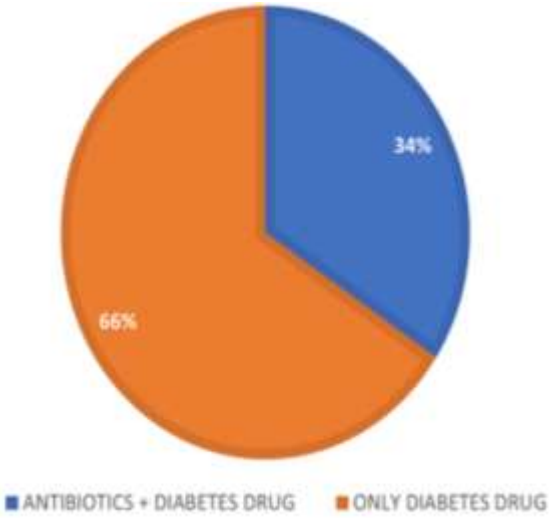

Fig: 7 Use of antidiabetic drug along with diabetic drug vs only diabetic drugs

During this study, 66% of patients consumed only diabetic drug and 34% of patients took both diabetic and antibiotic drugs.

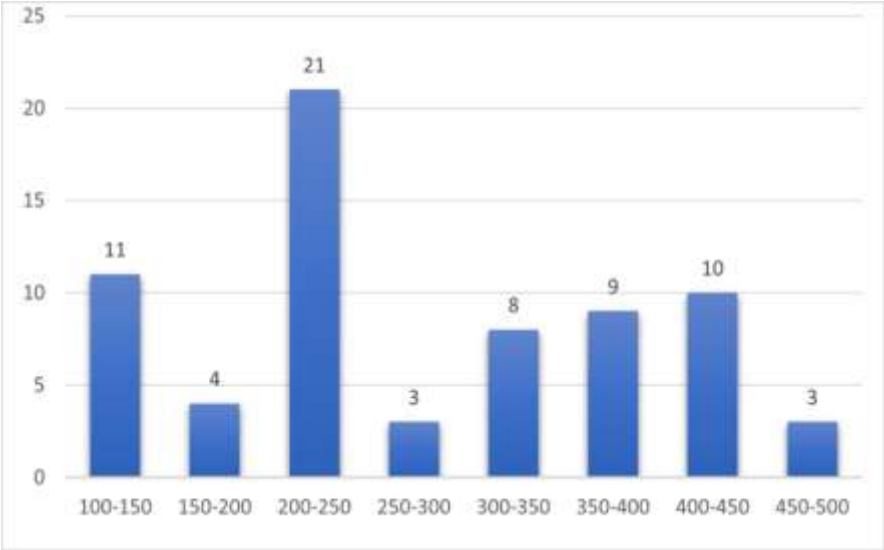

Fig: 8 Range of diabetes

In this study, patients are taken from various ranges of diabetes and the ranges are mentioned above.

Table No:5 Most common diabetes drugs prescribed in this study

DRUGS PRESCRIBED	FREQUENCY	PERCENTAGE
Metformin	25	12%
Voglibose	16	7.68%
Glimepiride	12	5.76%
Glycinorm	15	7.2%

vidagliptine	22	10.56%
dapagliflozin	15	7.2%
Combinational drugs		
Sitagliptine + metformin	15	7.2%
Metformin + voglibose	10	4.8%
Glimipride + metformin	22	10.56%
Vidagliptin + metfromin	12	5.76%
Metformin + glimepride + Pioglitazone	25	12%
Pioglitazone + Metformin	16	7.68%

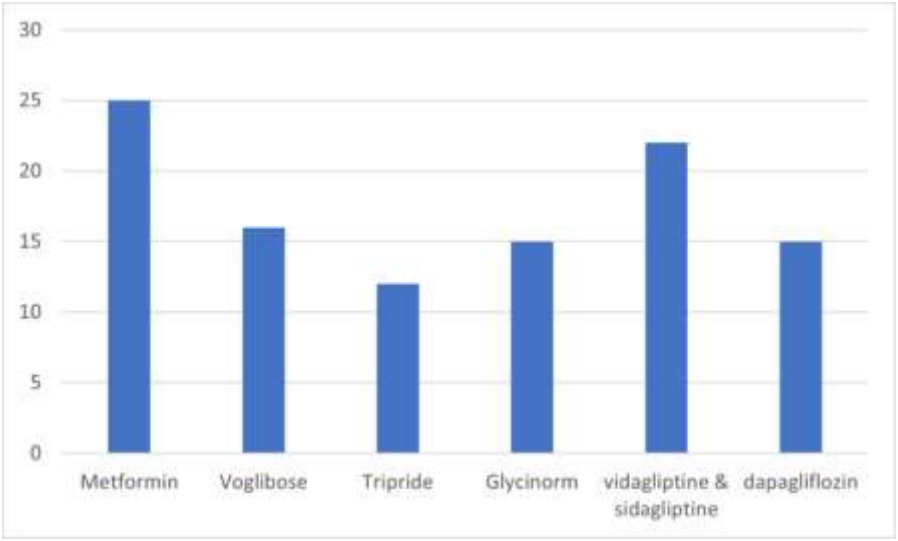

Fig 9: Amount of drugs that has been prescribed

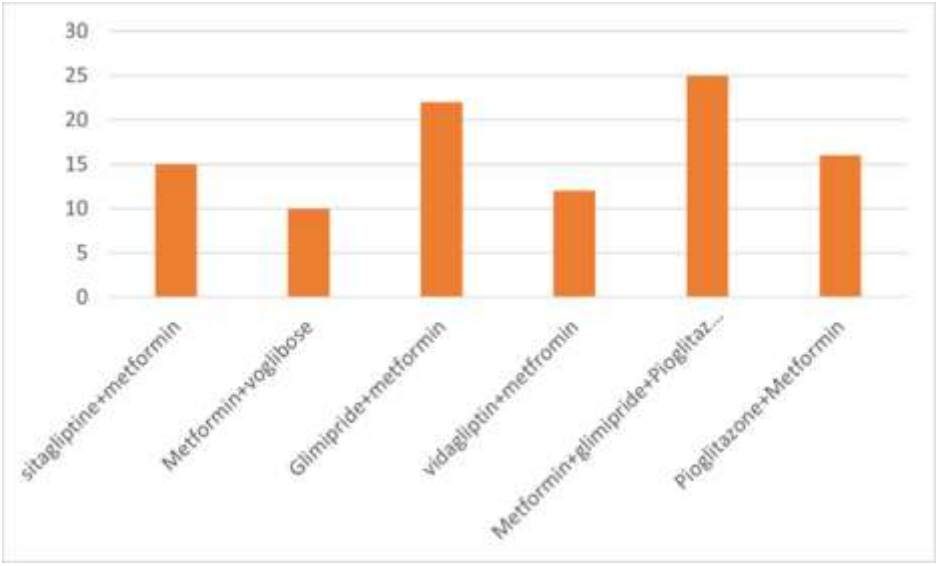

Fig 10: Amount of combinational drug prescribed

Table 6: Most commonly prescribed antibiotic drug

Antibiotic drugs	Frequency	Percentage
Azee	9	22.5%
Ceftum	7	17.5%
Cifran	5	12.5%
Ciplox	4	10%

Clavam	5	12.5%
Taxim	6	15%
Zenflox plus	4	10%

Table 7: Most commonly prescribed Insulin

Insulin	Frequency	Percentage
Human Actrapid	9	22.5%
Humulin R	5	12.5%
Lantus	4	10%
Novorapid	5	12.5%
Tresiba	5	12.5%
Aspart	8	20%
Human mixard	4	10%

Table 8: Result of study of drug through WHO prescribing guidelines (n=70)

Prescribing Indicator	Number of drugs (N)	Percentage (%)	Standard
Prescriptions with only one drug prescribed	55	23.4	
Prescriptions with injection drugs prescribed	40	17.02	13.4 - 24.1
Prescriptions with antibiotics prescribed	40	17.02	20.0% - 26.8%
Drugs prescribed by generic name	180	85%	100%
Prescriptions with five or more drugs prescribed (polypharmacy)	15	6.3	

According to the statistics, the most commonly given prescription for the treatment of diabetes in this dataset is metformin, either alone or in combination with other medications. The preference for multi-drug therapy in glycemic control is highlighted by the fact that metformin (12%) is the most often prescribed single medication, while metformin + glimepiride + pioglitazone (12%) is the most frequently prescription combination. Glimepiride + Metformin (10.56%) and Vidagliptin + Metformin (5.76%) are two of the most commonly utilised combinations, which reflects contemporary clinical methods that seek to achieve synergistic results through dual or triple medication therapy. A move towards contemporary antidiabetic therapies is also shown by the usage of SGLT2 inhibitors like dapagliflozin and DPP-4 inhibitors like Vidagliptin.

With 22.5% of prescriptions, Azee (Azithromycin) is the most often given antibiotic, according to the data on antibiotic prescriptions. This implies a preference for macrolide antibiotics, most likely because of their ability to effectively treat a variety of soft tissue and respiratory infections. Both cephalosporins, Ceftum (17.5%) and Taxim (15%), are also widely used, suggesting that broad-spectrum medications are used to treat bacterial infections that are either suspected or confirmed. Clavam (12.5%), Cifran (12.5%), Ciplox (10%), and Zenflox Plus (10%) are other often given antibiotics that demonstrate a balanced use of fluoroquinolones and beta-lactam/beta-lactamase inhibitor combos.All things considered, the pattern shows a propensity for broad-spectrum

antibiotics, which, despite their effectiveness, emphasise the significance of antibiotic stewardship to reduce resistance and encourage sensible prescribing practices.

Human Actrapid (22.5%) and Aspart (20%) are the most commonly used insulins, according to the insulin prescription statistics, demonstrating a strong preference for short-acting and rapid-acting insulins. These are frequently used to maintain strict glycemic control, particularly during mealtimes or in medical facilities.A balanced strategy between immediate and sustained glucose management is suggested by the consistent use of both short-acting and long-acting insulins by Humulin R, Novorapid, and Tresiba, each at 12.5%. Although they are used somewhat less frequently, Human Mixard (10%), a premixed insulin, and Lantus (10%), a well-known long-acting insulin, are nevertheless crucial components of individual treatment plans.In order to satisfy different clinical needs and maximise blood glucose control, the evidence generally shows a varied and patient-centered strategy to insulin therapy, combining rapid-, short-, intermediate-, and long-acting insulins.

DISCUSSION

Since hypertension is linked to morbidity, mortality, and economic burden on society, it remains a significant public health concern. It significantly increases the risk of renal, cerebrovascular, and cardiovascular problems. An estimated 1.56 billion people will have high blood pressure by 2025. The rising incidence of hypertension and the steadily rising cost of treating it have an impact on how doctors prescribe and how well patients adhere to their treatment plans. For the treatment of hypertension, several national and international guidelines have been released. Diuretics were once thought to be the first-line medication for treating hypertension, but the Joint National Commission's most recent guidelines (JNC8 guidelines) now recommend both calcium channel blockers and angiotensin-converting enzyme inhibitors as first-line medications in addition to diuretics. Combinations of antihypertensive medications are typically utilized to address comorbid disorders and provide excellent long-term control. The usage of antihypertensive drugs, their economic considerations, patient adherence to treatment, and doctors' compliance with prescription guidelines in various contexts, including India, are the main topics of this review. Studies of antihypertensive drug prescribing patterns aid in monitoring, assessing, and adjusting prescribing practices as needed to provide logical and economical treatment. Furthermore, the sensible use of antihypertensive medications that may be customized to meet the needs of patients, especially those in developing nations, is aided by novel drug formulations, prescription monitoring studies, and the periodic updating of suggested recommendations.

Similar findings were found in a study by Alkaabi MS, Rabbani SA, Rao PG et al. [32] ,which found that angiotensin receptor blockers and angiotensin-converting enzyme inhibitors (55.9%) were the most preferred agents for monotherapy, while calcium channel blockers were the most commonly prescribed class (51%) for both monotherapy and combination therapy. ACE inhibitors (34%) were the most prescribed medications, followed by CCBs (18%) and beta blockers (12%), in contrast to the study conducted by Nisha Rani SS, Nelta S Tharakan et al [17]. In contrast, CCBs were the most often prescribed medication as monotherapy in our study, and their most prevalent age group was between 51 and 60 years old, which was also the second most common age group in our study. To optimize and manage the pharmacological treatment,

prescription pattern studies are required. The purpose of the study by Narkar et al. was to examine the antihypertensive medication prescription pattern in a western Indian tertiary care hospital. The study's goals were to determine the pattern of medications administered for different co-morbidities, either alone or in combination. ARB was found to be the most often prescribed medication (41.5%), either by itself or in combination. ARB, CCB, and diuretic combinations were the most prevalent (35.7%), with multidrug therapy being the recommended treatment (56%). In hypertensive patients, diabetes mellitus was the most often reported comorbidity (39%), while the most usually prescribed antihypertensive medications were CCB and ARB.[33]

The present study represents the current prescribing pattern of Anti Hypertensive Drugs in our Hospital. Our findings showed that CCBs dominated the scenario of monotherapy among the elderly populations of hypertension followed by combination therapy of CCBs and ARBs. The use of Anti hypertensive drugs largely confirms the guidelines as most of the patients belonged to the category of elderly populations, but still there is a significant room of improvement in terms of rational prescribing. An examination of prescribing indicators reveals a generally logical pattern of drug usage, highlighting both key areas needing improvement and notable strengths. Focusing on therapeutic necessity and minimizing unnecessary medications, the percentage of prescriptions with only one drug (23. 4%) indicates a reasonable level of restraint in polypharmacy. This finding is further supported by the low percentage of prescriptions containing five or more medications (6. 3%), suggesting a cautious approach to reducing potential drug interactions and side effects, which is especially crucial for more susceptible patient populations.

Injection drug use accounts for 17. 02% of prescriptions, comfortably within the World Health Organization (WHO) recommended range of 13. 4% to 24. 1%. This suggests that physicians reserve injections for appropriate clinical causes, thereby lowering the possibility of complications associated with invasive medication administration and enhancing patient safety. However, two important areas demand attention. Firstly, 17. 02% of prescriptions include antibiotics, significantly less than the suggested range of 20. 0% to 26. 8%. This raises concerns about potential underprescription in situations where antibiotics may be clinically necessary, even if it initially seems favorable regarding antibiotic stewardship and reducing antimicrobial resistance. A more comprehensive clinical audit would be beneficial to ascertain that the lower percentage reflects proper prescribing practices rather than missed treatment opportunities. Secondly, only 85% of medications are prescribed under a generic name, which is below the ideal level of 100%.

Prescribing generics is a crucial aspect of sensible medication use, offering benefits such as lower costs, better accessibility, and reduced confusion from brand name variations. Despite the current data indicating that most medications are provided in generic form, further efforts are needed to promote complete adherence to accepted prescribing practices. Progress toward this goal could be supported by regular monitoring, policy enforcement, and educational initiatives. In the statistics reveal a largely logical approach to prescription practices, particularly regarding injectable drug use and polypharmacy. Nevertheless, there is room for improvement in the careful analysis of antibiotic prescribing patterns and consistent use of generic names. By addressing these issues through targeted training, audit feedback, and adherence to evidence- based

recommendations, prescribing practices can be further enhanced, ensuring patient care that is both effective and efficient.

CONCLUSION

This study provides valuable insights into the current prescribing patterns of anti-diabetic and anti-hypertensive medications among patients with associated comorbidities in a tertiary care setting. It highlights both the prevalent trends and the scope for improvement in rational drug use. Among hypertensive patients, calcium channel blockers (particularly amlodipine) and angiotensin receptor blockers were most commonly prescribed, aligning well with the JNC 8 guidelines, especially among the elderly population. Monotherapy remained the most preferred approach, although a significant number of patients received combination therapy to effectively manage comorbid conditions. The most frequent comorbidities observed were diabetes mellitus and chronic kidney disease, which justifies the use of multiple drug regimens for better clinical outcomes.

In diabetic patients, metformin was identified as the most prescribed drug, both individually and in combination with other oral hypoglycemic agents such as glimepiride, pioglitazone, and vidagliptin. The pattern reflected a balanced integration of modern therapeutic strategies, including DPP-4 inhibitors and SGLT2 inhibitors, alongside traditional agents. However, despite polypharmacy in several prescriptions, only 41% of patients achieved adequate glycemic control, indicating the need for optimized therapeutic interventions, patient education, and strict monitoring. The WHO prescribing indicator analysis revealed commendable efforts in minimizing polypharmacy and maintaining prudent use of injectable medications. However, there was a need for improvement in prescribing drugs by generic names and rational antibiotic use. These findings emphasize the need for continual medical education, periodic audits, and adherence to evidence-based guidelines to ensure cost-effective and safe therapy.

In conclusion, while the study demonstrates compliance with standard treatment protocols in many areas, it also highlights critical gaps in drug utilization that could be addressed through targeted interventions. Improving prescribing practices and encouraging lifestyle modifications will significantly enhance therapeutic outcomes in hypertensive and diabetic populations, particularly those with multiple comorbidities

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