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Research Article

DRUG UTILIZATION STUDY ON ORAL HYPOGLYCEMIC AGENTS IN TYPE 2 DIABETIC PATIENTS OF TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: The main objective of the study is to determine the patient demographic characteristics, inspect prescription patterns of oral hypoglycemic agents, and distribution of comorbid conditions in the outpatient department (OPD) of Visakha Institute of Medical Sciences (VIMS), Visakhapatnam.

Methods: A prospective observational study was conducted in patients with established type 2 diabetes mellitus (n=185) visiting OPD who were interviewed using a structured questionnaire during the period September–December 2019. Statistical analysis used is Chi-square test, mean±standard deviation.

Results: The majority of type 2 diabetic patients in VIMS were treated with double-drug therapy. The most commonly prescribed class of oral hypoglycemic agents were biguanides (metformin) followed by sulfonylureas (glimepiride), thiazolidinediones (pioglitazone), alpha-glucosidase inhibitor (voglibose), and dipeptidyl peptidase-4 inhibitor (vildagliptin).

Conclusion: Our study concluded that diabetes mellitus is more prevalent in females than in males, mostly seen in the age group of 50–59 years(y) old patients. Glycemic levels are under control in patients who show good adherence to treatment and with lifestyle modifications. Due to lack of awareness, many patients are with uncontrolled glycemic levels so proper patient educated should be provided.

Keywords: Diabetes mellitus, Hyperglycemia, Oral hypoglycemic agents, Questionnaire, Prospective study, Insulin resistance, International Diabetes Foundation, Indian Heart Association, Coexisting illness, Drug therapy regimen.

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INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia and abnormalities in carbohydrate, fat, and protein metabolism [1,2] resulting from defects in insulin secretion, insulin action, or both [3,4].

Chronic condition of diabetes is associated with long-term damage and dysfunction, failure of various organs, especially blood vessels, eyes, kidneys, nerves, and heart. To prevent the risk of long-term complications, there is a need for appropriate medical care and patient self-management education [4]. Until recently, India had more diabetics than any other country in the world, according to the International Diabetes Foundation diabetes currently affects more than 63 million Indians, which is more than 7.4% of the adult population, nearly 1 million Indians die due to diabetes every year. Indian Heart Association shows that India is estimated to be hoe to 110 million individuals with diabetes by 2035 [5].

The high incidence is attributed to a combination of genetic susceptibility and adoption of high calorie, low activity. Because of the following reasons, Indians have a low-risk threshold for diabetes: Overweight, higher insulin resistance, lifestyle, higher central obesity for a given BMI, a higher fat mass, lower age of onset, and an occurrence at lower body mass index (BMI > 23). Oral hypoglycemic drugs are used in the treatment of diabetes, which is a disorder involving resistance to insulin secretion [3-6].

At present, among many classes of OHA, sulfonylureas and biguanides class of drugs are most commonly prescribing and for monotherapy, metformin is prescribing mostly followed by glimepiride, pioglitazone, and vildagliptin.

Drug utilization is defined as the distribution, marketing, prescription, and use of drugs in the society, resulting in medical and social consequences. This type of study will create a sound sociomedical and sound economic basis for health-care decision-making (Table 1).

The main aim of this drug utilization study is to assess patient adherence to therapy, the outcome of the drug therapy regimen, how the OHA is prescribing, OHA is prescribing properly or not, and whether drug therapy is rational or not.

METHODS

The study was carried out at the Department of Endocrinology in Visakha Institute of Medical Sciences (VIMS), Visakhapatnam, to determine patient demographic characteristics, analyze prescription patterns of oral hypoglycemic agents, and distribution of comorbid conditions in the outpatient department. All patients with established type 2 diabetes attending the endocrinology department in the hospital were included in the study during the period September–December 2019.

Information on age, gender, weight, family history, blood sugar levels, glycosylated hemoglobin (HBA1c) levels, and oral hypoglycemic agents was documented. The patient counseling was conducted using a structured questionnaire (open question method):

- Do you forget to take your medicine?
- Are you careless about taking your medicine?
- When you feel good, do you sometimes stop taking medicine?
- Sometimes if you feel worse while taking medicine, do you stop taking it?

A higher score on the scale of 0–4 indicates better adherence to treatment (yes=0; no=1) [6,7].

The study data were analyzed using the Chi-square test that was used for categorical data to test for the association.

Ethical approval

This study was approved by the ethical committee of the hospital VIMS.

RESULTS

Gender distribution of patients

Gender distribution of patients: It is found that diabetes is most commonly occurring in females than males (Fig. 1).

Table 1: List of oral hypoglycemic agents and their classes [3,4]

Class	Mechanism	Agents	Advantages	Disadvantages
Biguanides	Decrease hepatic gluconeogenesis	Metformin	No hypoglycemia, weight normal, easily available	GI disturbance, lactic acidosis
Sulfonylureas	Stimulate insulin secretion	Glimepiride, gliclazide, glibenclamide, glipizide, tolbutamide	Cost effective, easily available	Hypoglycemia, weight gain
Thiazolidinediones	Improve insulin resistance	Pioglitazone	Lower insulin requirements	Edema, CHF, weight gain, fracture, macula edema
Alpha-glucosidase inhibitors	Decrease insulin absorption	Acarbose, voglibose	Reduce postprandial blood glucose levels	GI flatulence
DPP 4 inhibitors	Prolong GLP-1 action	Vildagliptin, saxagliptin, sitagliptin	No hypoglycemia	Not available
Meglitinides	Stimulate insulin secretion	Repaglinide, nateglinide	The short onset of action, low postprandial blood glucose levels	Hypoglycemia

Family history of diabetes mellitus

An analysis of the questionnaire revealed that among 185 diabetic patients, 104 (56.2%) patients had a family history of diabetes. The percentage of patients with no family history of diabetes was found to be 81 (43.8%).

Age distribution of patients

Diabetic patients who visited the endocrinology department were in the age group ranging from 30 to 80 years old (Fig. 2).

Social history

Among 59 (32%) male diabetic patients, 51% of patients were smokers and 30% of patients were alcoholics.

Patients who are chronic alcoholic their blood sugar levels were found to be >270 mg/dl even though patients are on multiple drug therapy [8].

These patients are counseled to reduce the intake of alcohol and smoking by showing their blood sugar levels and also risk behind abruptly stop smoking and alcohol which will cause withdrawal symptoms such as nausea, anorexia, confusion, palpitations, and seizures.

Distribution of coexisting illnesses

Distribution of coexisting illnesses: among (n=185) diabetic patients 57% had associated hypertension, 40% had associated dyslipidemia, and overweight. It is observed that overweight is the main cause of diabetes mellitus in most patients. Many patients are also suffering from other comorbid conditions like thyroid, cardiovascular diseases, stroke, etc. (Fig. 3).

Distribution of drug therapy regimen

The most commonly prescribed drug for monotherapy is metformin OD or BD or insulin and commonly prescribed double-drug therapy is metformin+glimepiride or insulin commonly prescribed triple-drug therapy regimens are metformin+glimepiride+pioglitazone or with insulin or voglibose, but generally for triple- and multiple-drug therapy insulin will not be prescribed. If patient blood sugar levels are high, drug dose should be increased or other classes of the drug should be added. If blood sugar levels low, reduce drug dose or omit a drug [9,10] (Figs. 3 and 4).

Distribution of oral hypoglycemics

The most commonly prescribed and available OHA in VIMS are metformin, glimepiride, pioglitazone, voglibose, and vildagliptin (Fig. 5).

Adherence to treatment

An analysis of the questionnaire revealed [10] (Fig. 6):

Optimal glycemic control

Among n=185, type-2 diabetic patients who are receiving OHA 111 (60%) had controlled optimal glycemic levels and 74 (59%) had inadequately controlled glycemic levels [11] (Figs. 7 and 8).

Association between optimal glycemic levels was statistically significant in diabetic patients on antidiabetic therapy with lifestyle modifications

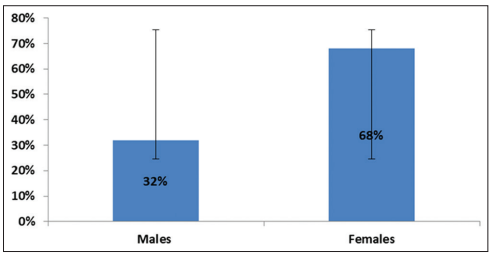

Fig. 1: Gender distribution among type-2 diabetic patients [7]. One hundred and eighty-five diabetic patients were evaluated during the study period September–December, of whom 59 (32%) patients were male and 126 (68%) patients were female

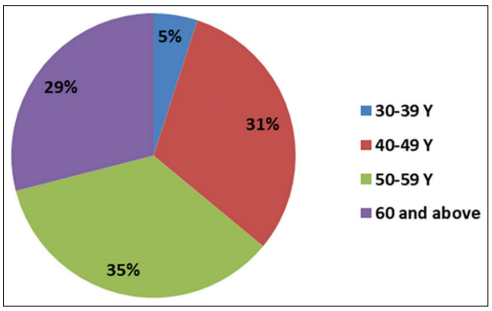

Fig. 2: Age distribution among type-2 diabetic patients [7]. Among 185 diabetic patients, the age group of 30–39 years included 10 (5%) patients. The age group of 40–49 years included 57 (31%) patients. The age group of 50–59 years included 65 (35%) patients. The age group of 60 years and above included 46 (29%) patients. Most of the diabetic patient is seen in the age group of 50–59 years old with the mean age of 44.5±24.2

(p=0.014); however, this association with therapy type and other data was not significant statistically (p>0.05) (Table 2, Figs. 9 and 10).

DISCUSSION

This study showed that the majority of diabetic patients ranged between 50 and 60 years old with a mean age of 44.5±24.2. While Moradi *et al.* [12] also concluded that diabetes was more frequent in the age group of 50–60 years which is similar to our study, these reports showed that diabetes starts in lower ages in our society that shows the need for screening for diabetes from an early age (>45 years), especially patients who have a family history [13] of diabetes mellitus and cardiovascular diseases.

Our results showed that diabetes is more prevalent in females than in males which were not agreed with the results of other studies [14]. The risk of type 2 diabetes is 1.76% greater in females compared to males in our country [15]. This may be related to the fact that obesity, hypertension, and cardiovascular diseases because they normally less physical activity compared to men, so weight control programs and following lifestyle modifications are strongly recommended in this population.

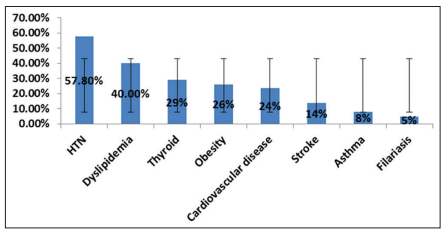

Fig. 3: Percentage of comorbidities among type-2 diabetic patients [8]. Among 185 patients, 107 (57.8%) patients had associated hypertension, 74 (40%) patients had associated dyslipidemia, 44 (23.7%) patients had associated cardiovascular disease, 54 (29%) patients had associated thyroid problems, 48 (26%) patients had obesity, 26 (14%) patients had associated stroke, 15 (8%) patients had associated asthma, and 9 (5%) patients had associated filariasis with the mean standard deviation of 38.5±23

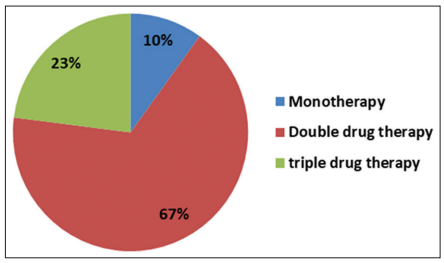

Fig. 4: Drug therapy regimen [8]. The majority (67%) of patients were on double-drug therapy, 23% were prescribed with triple-drug therapy, and 10% were prescribed monodrug therapy with the mean standard deviation 61.1±55.4

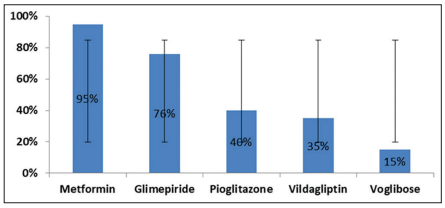

Fig. 5: Percentage of oral hypoglycemic agents. Among total oral hypoglycemics, metformin accounted for 95% followed by glimepiride 76%, pioglitazone 40%, vildagliptin 35%, and voglibose 18%

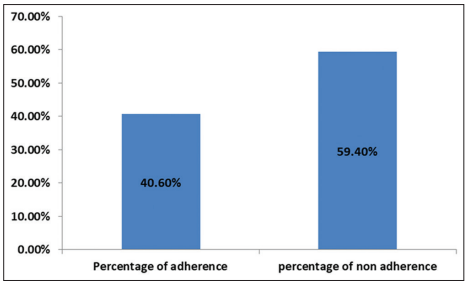

Fig. 6: Percentage of patient's adherence to treatment [10]. Among 185 of diabetic patients, only 75 (40.6%) patients showed good adherence to treatment and the remaining 110 (59.40%) showed non-adherence to the treatment with a mean standard deviation of 92.5±22.7

This study shows that biguanides were the most commonly prescribed class followed by sulfonylureas were the most commonly prescribed class of drugs which was similar to a previous study [16-18]. This reflects that biguanides and sulfonylureas are the choices of most physicians in the treatment of type 2 diabetes mellitus. Metformin (biguanide) 95% was the most common oral hypoglycemic agent to be prescribed which is similar to several studies [6,18-21] followed by glimepiride (sulfonylureas) 76%. The study documented low prescribing frequency of newer oral hypoglycemic agents such as pioglitazone and vildagliptin, they were used in a combination with sulfonylureas or biguanides to achieve better glycemic control which was similar to the previous studies [6,16].

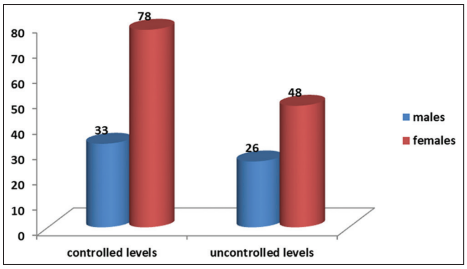

Fig. 7: Among 126 female patients and 59 male patients, 78 female patients and 26 male patients are under glycemic control which is not significant statistically (p=0.897)

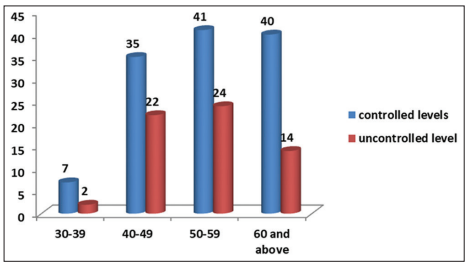

Fig. 8: Patients of the age group of 30–39 years are mostly under glycemic control, some patients of age group of 40–49 years, 50–59 years, and 60 and above years old are under optimal glycemic control, and some are not under optimal controlled levels, the association is statistically not significant (p=0.896)

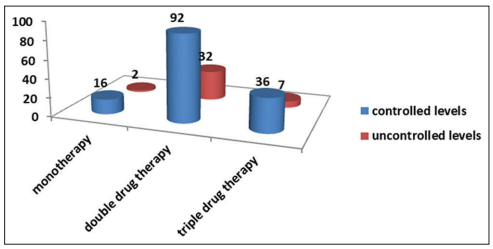

Fig. 9: Patients under double-drug therapy regimen are showing good glycemic control (92 patients) than triple-drug therapy. Patients under monotherapy are not showing a proper glycemic control and the association is not statistically significant (p=0.696)

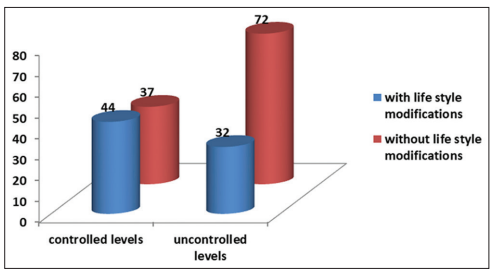

Fig. 10: Patients with lifestyle modifications are showing good glycemic control (76 patients) and patients without lifestyle modifications are not under glycemic control (109 patients). This shows that many patients need to adopt good lifestyle modifications and this association is statistically significant (p=0.014)

In this study, drugs were prescribed by generic name which is a most commonly advisable method for easy understanding and to avoid patient and pharmacist-related errors. In this study, drugs were prescribed from the national essential drug list which shows the awareness and selection of drugs from an essential drug list for rational use of drugs.

About 60% of patients on antidiabetic therapy had controlled optimal glycemic levels, while 40% had inadequate/uncontrolled glycemic levels. Many studies have documented from 52% to 88% which were higher than our studies [22-26], these variations are may be due to differences in methods

Table 2: Characteristics of diabetic patients based on glycemic control

Patient characteristics	Glycemic level		Total (n=185)	p value
	Controlled	Uncontrolled		
Gender				
Male	33	26	59	0.897
Female	78	48	126	
Age (years)				
30–39	7	2	9	0.896
40–49	35	22	57	
50–59	41	24	65	
60 above	40	14	54	
Therapy type				
Monotherapy	16	2	18	0.696
Double-drug therapy	92	32	124	
Triple-drug therapy	36	7000	43	
Antidiabetic therapy				
With lifestyle modifications	44	32	76	0.014
Without lifestyle modifications	37	72	109	

of data collection, measurement of blood glucose levels such as pre-prandial and post-prandial levels, and the difference in the population surveyed.

The most prevalent antidiabetic therapy was double-drug therapy, the most commonly prescribed double-drug therapy is metformin+glimepiride or insulin or pioglitazone or vildagliptin. However, the study by Willey *et al.* has shown good glycemic control on monotherapy [24]. This study shows glycemic control with monotherapy and combination therapy was not significant statistically $p>0.05$ (0.696) and we found a statistically significant ($p<0.05$) association between glycemic control and antidiabetic therapy with lifestyle modifications. Thus, from the above results, it shows that lifestyle modifications with antidiabetic therapy have the potential to improve glycemic control in patients with type 2 diabetes mellitus [27-29].

CONCLUSION

From this study, it is concluded that double-drug therapy was more used than monotherapy, in this, metformin and glimepiride combination drugs were commonly used followed by metformin and pioglitazone, mostly prescribing in an oral dosage form. Patients with lifestyle modifications showed controlled blood sugar levels than patients without lifestyle modifications. Polypharmacy is a big problem, especially for elderly patients, due to illiteracy, lack of awareness, and negligence, many patients show non-adherence to the treatment. This study mainly focused on the need for patient education or counseling on diabetes mellitus disease, the use of antidiabetic and concomitant drugs, monitoring of blood glucose and HBA1c levels, diet control, physical activity, and complications of diabetes mellitus, by providing the above information can reduce the chance of medication errors and can improve adherence to treatment.

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AUTHORS' CONTRIBUTIONS

Data collection, literature search, design, analysis, interpretation of data, and proofreading done by Saragadam Buvaneswari.

CONFLICTS OF INTEREST

No conflicts of interest.

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