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Original Research Article

Pharmacoecomonic study of oral antidiabetic drugs available in Indian pharmaceutical market

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ABSTRACT

Background: Diabetes mellitus is a metabolic disorder requiring lifelong medication which further adds to comorbidity. Cost of the drug pays an important role in adherence and compliance to the treatment. There is a wide variation in prices of oral hypoglycemic drugs available in Indian pharmaceutical market. Aims and objectives of the study was planned to evaluate cost of oral antidiabetic drugs of various brands currently available in Indian market either as single drug or in combination.
Methods: Cost of antidiabetic medications manufactured by various pharmaceutical companies in the same strength and dosage form was obtained from the price list provided by various pharmaceutical companies in current index of medical specialties December 2022-March2023. The cost ratio and percentage price variation for each formulation was calculated and analyzed.
Results: Among single antidiabetic drugs, Tab. Metformin 500 mg shows highest percentage price variation (809%) and highest cost ratio (9.09). Among fixed dose combinations, Tab. Glibenclamide 5 mg + Tab. Metformin 500 mg shows highest percentage price variation 300.8% and highest cost ratio 4.
Conclusions: Our study shows that there is high price variation for oral anti diabetics. It is important to bring awareness about wide variation in prices so that drug cost can be reduced and made affordable to common man which plays major role in compliance of patient.

Keywords: Diabetes mellitus, Oral hypoglycemic drugs, Compliance

INTRODUCTION

Drug cost plays major role in long-term compliance and adherence to the treatment of the patients. Indian pharmaceutical market has large number of generic and branded formulations of the same drug with wide variations in selling price. Higher cost therapy and longer duration of treatment will have adverse economic consequences leading to non-adherence and poor compliance of patients. In developing countries like India, expenses for the treatment is out of pocket for poor people which dragged below poverty line as majority of people are not covered by insurance. Insurance schemes are underutilized and health-care cost are afforded by poor patients. Cost association is very large with treatment of diseases especially diabetes mellitus (DM). Cost of anti-diabetic drug is major deciding factor for compliance. Cost of drug became a major challenge in treatment of diabetes and also compliance toward treatment which makes difficult for physician to choose least expensive drug for their patients for the treatment of DM especially Type 2 diabetes. Increase in cost of antidiabetic drugs lead to worse compliance of patient, low quality of life, and more

financial burden on patients.[2] The WHO defined DM as "A metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbance of carbohydrate, fat, and protein metabolism resulting from the defects in insulin secretion, insulin action, or both".[2] In developing countries like India, high incidence of DM is due to urbanization, high calorie food intake along with sedentary life style in genetically predisposed individuals.[3]

Diabetes is considered as expensive disease because of its chronic nature, severity of complications and medications required to control them for affected individuals and healthcare system.[4] There are a large number of anti-diabetic drugs available in Indian pharmaceutical market in various dosage forms in various brands with wide range of prices such as Sulfonylureas, Biguanides, Gliptins, Glitazones, Alpha glucosidase inhibitors, and Amylin antagonists that are available to treat Type 2 diabetes.[1] In 1997, National Pharmaceutical Pricing Authority was established for ensuring availability and affordability of drugs. Under NPPA, Drug Price Control Order is established in 2013 to cut down the cost of essential drugs.[5]

Government authorize NPPA to regulate price of medicines which are included in National list of essential medicines (NLEM) including 348 medicines in 2013.[6] Recently, NPPA revised list and included 459 medicines in the list in DPCO Nov 2022. Government is making every effort for ensuring the availability and affordability of medicines for all citizens of India. NPPA regulates medicine prices of not only NLEM but also medications which are not enlisted in NLEM (non-NLEM).[7] Every pharmaceutical company makes prices of medicines; they manufacture without jeopardizing their profit. Due to large population in countries like India, as there is no well-defined social security system, Indian population is getting financially stressed to severe extent every year due to rising health care costs.[8] The knowledge of cost variation in anti-diabetic drug helps to develop cost-effective treatment regimen which reduces risk of therapy failure and increases patient compliance; hence, cost analysis of antidiabetic drugs is needed. Cost analysis is a type of pharmacoeconomic evaluation in which comparison of costs of two or more alternative medication made without regard to outcome.[9,10] Percentage price variation is an effective tool to find out cost difference between various brands of antidiabetic drugs. The knowledge and awareness on cost variation among anti diabetic drugs can be applied to ensure more economical treatment to improve treatment adherence and rate of success of therapy.[11]

The knowledge of cost variation in anti-diabetic drug helps to develop cost-effective treatment regimen which reduces risk of therapy failure and increases patient compliance; hence, cost analysis of antidiabetic drugs is needed. Cost analysis is a type of pharmacoeconomic evaluation in which comparison of costs of two or more alternative medication made without regard to outcome.[9,10] Percentage price variation is an effective tool to find out cost difference between various brands of antidiabetic drugs. The knowledge and awareness on cost variation among anti diabetic drugs can be applied to ensure more economical treatment to improve treatment adherence and rate of success of therapy.[11] The present study was planned to evaluate cost of oral antidiabetic drugs of various brands currently available in Indian market either as single drug or in combination.

METHODS

Study type, location and duration

This is an observational study planned to analyze price variation among different brands of antidiabetic drugs available in Indian market.[12] The study was carried out at Amlatas Hospital Dewas (a tertiary hospital) in Madhya pradesh (India). Total duration of this study was 4 months (1 January 2023 to 1 April 2023).

Selection criteria

Cost of the particular drug for 10 tablets in same strength and dosage form being manufactured by different companies was included in the study.

Exclusion criteria

Drugs being manufactured by one company and being manufactured by different companies in different strengths were excluded from the study.

Procedure

The cost of individual antidiabetic medication in same dose and dosage form manufactured by different companies was compared. Current index of medical specialties (CIMS December 2022-March 2023) was used to analyze cost of antidiabetic drugs available in various brands in Indian pharmaceutical market.

Antidiabetic drugs and tablet formulations were analyzed. Cost of the total (11 single and eight combinations) preparations available in different formulations were analyzed. The cost ratio and percentage price variation for each individual drug strength formulation were calculated. Microsoft word and excel have been used to generate table. Cost ratio is the ratio of cost of most expensive drug to least expensive drug formulation.

It helps to determine how many times the most expensive formulation is costlier than least expensive formulation of same drug.[10] Cost ratio = Maximum cost of the brand/Minimum cost of the brand.[4-13] The cost ratio was calculated using formula.[10,11]

$$Cost\ ratio\ =\ (Maximum\ cost)/(Minimum\ cost)$$

Percentage price variation was calculated using formula.[12-14]

$$Percentage\ price\ variation = [(Maximum\ Cost - Minimum\ Cost) \times 100] / Minimum\ Cost$$

Statistical analysis

The cost variation was analysed with SPSS software 2.0 version with tools of median and interquartile range.

RESULTS

This study includes 11 single and eight combinations of anti-diabetic drugs. Of these, four drugs belong to group Sulfonylureas, two drugs belong to group alpha glucosidase inhibitors, one drugs belong to group Biguanide, one drugs belong to group Meglintidine analog, two drugs belong to group DPP-4 inhibitors, and one drug belongs to group.

Table 1: Percentage price variation and cost ratio of single antidiabetic drugs.

Drug Strength	No of formulation	Max cost	Min cost	% variation	Cost ratio
Tab Acarbose (25 mg)	4	83.50	54.60	53.21	1.53
Tab Glibenclimide (5 mg)	2	9.85	6.71	46.80	1.46
Tab Gliclazide (30 mg)	5	81.40	18.22	346.70	4.46
Tab Glimipiride (1 mg)	37	40.10	14.50	176.00	2.76
Tab Glipizide (5 mg)	4	7.25	4.55	59.30	1.59
Tab metformin (500mg)	34	40.00	4.40	802.00	9.09
Tab Pioglitazone (15mg)	13	59.99	15.00	299.00	3.99
Tab Repaglinide (1 mg)	4	95.00	44.00	115.00	2.15
Tab Voglibose (0.2mg)	25	95.00	21.00	352.00	4.52
Tab. Teneligliptin (20 mg)	19	130	55.00	136.00	2.36
Tab. Vildagliptin (50 mg)	5	110	69.00	59.00	1.59
Dapagliflozin (10 mg)	10	462	124.00	410	3.30
Empagliflozin (25 mg) (Jardiance 25mg)	1	513.00	NA	NA	NA

n: Number of brands, Max cost: Maximum cost per 10 drugs, Min cost: Minimum cost per 10 drugs, %PV: Percentage price variation, CR: Cost ratio, Tab: Tablet

Table 2: Percentage cost variation and cost ratio of combination of antidiabetic drugs.

Drug Strength	No of formulation	Max cost	Min cost	% variation	Cost ratio
Tab. (Glibenclamide 5 mg+Metformin 500 mg)	13	64.13	16.00	300.20	4.0
Tab. (Glimipride 1 mg+Metformin 500 mg+Pioglitazone 15 mg)	17	127.10	49.00	159.00	2.6
Tab. (Glimipride 1 mg+Metformin 500 mg+Voglibose 0.2 mg)	13	163.33	85.00	92.00	1.92
Tab. (Glimipride 1 mg+Metformin 500 mg	50	102.00	30.45	234.00	3.34
Tab. (Metformin 500 mg+Pioglitazomne 15 mg)	10	84.00	36.40	130.00	2.30
Tab. (Glipizide 5 mg+Metformin 500 mg)	5	16.85	11.64	44.70	1.44
Tab. (Teneligliptin 20 mg+Metformin 500 mg)	18	141.43	79.00	79.00	1.79
Tab. (Metformin 500 mg+Voglibose 0.2 mg)	14	108.00	49.00	120.00	2.20
Tab. (Glibenclamide 5 mg+Metformin 500 mg)	13	64.13	16.00	300.20	4.0
Tab. (Glimipride 1 mg+Metformin 500 mg+Pioglitazone 15 mg)	17	127.10	49.00	159.00	2.6
Tab. (Glimipride 1 mg+Metformin 500 mg+Voglibose 0.2 mg)	13	163.33	85.00	92.00	1.92
Tab. (Glimipride 1 mg+Metformin 500 mg	50	102.00	30.45	234.00	3.34
Tab. (Metformin 500 mg+Pioglitazomne 15 mg)	10	84.00	36.40	130.00	2.30

Thiazolidinedione shows wide cost variation in cost of different brands of same anti diabetic drug in Indian market. Among Sulfonylureas, two brands were available for Tab. Glibenclamide 5 mg, five brands were available for Tab. Gliclazide 30 mg, 37 brands were available for Tab. Glimipride 1 mg, and four brands were available for Tab. Glipizide 5 mg. Among Biguanides, 34 brands were available for Tab. Metformin 500 mg. Among DPP-4 inhibitors, 19 brands were available for Tab. Teneligliptin 20 mg and five brands were available for Tab. Vildagliptin 50 mg. Among alpha-glucosidase inhibitors, 25 brands were available for Tab. Voglibose 0.2 mg and four brands were available for Tab. Acarbose 25 mg (Table 1).

Among fixed dose combinations,50 brands were available for Tab. (Glimipride 1 mg + Metformin 500 mg), 17 brands were available for Tab. (Glimipride 1 mg + Metformin 500 mg + Pioglitazomne 15 mg), 13 brands were available for (Tab. Glimipride 1 mg + Metformin 500 mg +Voglibose 0.2 mg), five brands were available for (Tab. Glipizide 5 mg + Metformin 500 mg), 10 brands were available for (Tab. Metformin 500 mg + Pioglitazomne 15 mg), and 14 brands were available for Tab. (Metformin 500 mg + Voglibose 0.2 mg), respectively [Table 2]. Variation is Tab. Metformin 500 mg (809%) with cost ratio (9.09) followed by Tab. Voglibose 0.2 mg (352%) with cost ratio (4.52), Tab. Gliclazide 30 mg (346.7%) with cost ratio (4.46), Tab. Pioglitazone 15 mg (299%) with cost ratio (3.99) Tab. Glimipride 1 mg (176%) with cost ratio (1.76), Tab. Teneligliptin 20 mg Tab (136%) with cost ratio (2.36), and Tab. Repaglinide 1 mg (115%) with cost ratio (2.15).

Highest percentage price variation is Tab. Glibenclamide 5 mg + Tab. Metformin 500 mg (300.8%) with cost ratio 4 followed by Tab. Glimipride 1 mg + Tab. Metformin 500 mg (234%) with cost ratio 3.34, Tab. Glimipride 1 mg + Tab. Metformin 500 mg + Tab. Pioglitazone 15 mg (159%) with cost ratio 2.6, Tab. Metformin 500 mg + Tab. Pioglitazone 15 mg (130) with cost ratio (2.3), and Tab. (Metformin 500 mg + Voglibose 0.2 mg) (120) with cost ratio (2.2).

DISCUSSION

In this study, Sulfonylureas, Biguanides, Gliptins, and Glitazones groups were analyzed. Most of the antidiabetic drugs have percentage price variation above 100%, which is not favourable situation. Among single antidiabetic drugs, Tab. Metformin 500 mg shows highest percentage price variation (809%) and highest cost ratio (9.09). Most expensive formulation of this drug 176 times costlier than least expensive formulation. Tab. Glibenclamide 5 mg shows lowest percentage price variation 46.8% and lowest cost ratio 1.46. Among fixed dose combinations, Tab. Glibenclamide 5 mg + Tab. Metformin 500 mg shows highest percentage price variation 300.8% and highest cost ratio 4. Tab. Teneligliptin 20 mg + Tab. Metformin 500 mg shows lowest percentage price variation 79% and lowest cost ratio 1.79. Unlike in our study, the study by Aran et al shows, Tab. Pioglitazone 15 mg has highest percentage cost variation 185.7% and Tab. Acarbose 25 mg shows lowest percentage price variation 117.18% and study by Acharya et al shows Tab. (Glimipride + Metformin + Pioglitazone) shows lowest percentage price variation 1.47% and Tab. (Glipizide 5 mg + Metformin 500 mg) shows lowest price variation 44.7%.[1-3]

In our study, Tab. Metformin 500 mg shows highest percentage price variation 809% and highest cost ratio 9.09 and Tab. Glibenclamide 5 mg shows lowest percentage price variation 46.8% and cost ratio 1.46. When compared with other studies like study by Shyam and Mahanthegowda shows, Tab Glimipride 1 mg has maximum percentage price variation 1366% and cost ratio 14.66. and Tab. Acarbose 100 mg shows lowest percentage price variation 10% and cost ratio 1.10. Whereas study by Mehani and Sharma shows Tab. Glimipride 2 mg has maximum price variation of 562%, while Tab. Glipizide 2.5 mg shows minimum price variation of 81%. and Tab. Metformin 500 mg shows highest cost ratio 5.9 and Tab. Glipizide 2.5 mg lowest cost ratio 1.81.[4-11]

Among fixed dose combinations in our study, Tab. Glibenclamide 5 mg + Tab. Metformin 500 mg shows highest percentage price variation 300.8% and highest cost ratio 4 and Tab. Teneligliptin 20 mg + Tab. Metformin 500 mg shows lowest percentage price variation 79% and lowest cost ratio 1.79. Reason for this difference in the results of cost analysis among various studies is because of increase in number of manufacturing companies and new brands entering into market with different formulations. As number of manufacturing companies increases, percentage price variation also increases. Another reason, among oral antidiabetic drugs, only Metformin, Glimipride, and Teneligliptin drugs were included in latest DPCO November 2022 list while other oral anti diabetic drugs are not included in the study. Percentage increase in price of drugs under DPCO is less than those that are not under DPCO.

Number of oral anti diabetic drugs under DPCO are decreased; hence, cost of therapy had increased which had become economic burden to poor population and non-adherence to treatment. It became difficult for the physicians to select appropriate drug due to unavailability of information about comparative drug prices. Physicians who prescribe drugs need to be aware of drug cost incurred by the patients. Awareness of cost variations among antidiabetic drugs improves treatment adherence and rate of success of therapy.[12-15]

Strengths and limitations

Strength of our study is sources of information obtained from CIMS April to July 2022 which includes single and combination drugs. Limitation is only oral anti diabetic drugs are included and insulins (injectables) are not included in this study.

CONCLUSION

Since diabetes is a common disease requiring long-term therapy, such wide price variation should not be encouraged. The cost of drugs plays an important role in patient care, warranting the need for all physicians to keep themselves updated with latest prices and price variation of different brands available for individual anti diabetic drug. It is important to bring awareness about wide variation in prices so that drug cost can be reduced and made affordable to common man which plays major role in compliance of patient. Prescribing by generic names, availability of manual of comparative drug prices and implementation of price control policies should be encouraged to reduce the cost of treatment and promote rationale use of drugs and increase patient compliance to treatment. In addition, government should frame life-saving policies and essential drugs under DPCO to ensure cost effective therapy and prescribing generic drugs reduce cost difference between different brands.

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